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(54) SHEET DISTRIBUTING METHOD AND APPARATUS.

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Description

The present invention relates to a method and apparatus for distributing sheets of material, for example machine-copied prints on a flexible sheet of paper or the like, including the sorting, stacking, collating etc. of printed sheets.

Background of the Invention

It is often desirable to distribute printed sheets in various predetermined ways, for example to form stacks of prints of predetermined content, or to collate such prints into appropriate sets. For example, the pages of a book, or a packet of engineering drawings or maps, may be printed and sorted or collated into the desired book or packet form.

One such application in connection with which this invention will be described involves the distributing of such prints into separate bins of a print-receiving apparatus which is designated herein as a collator, although it may be used for purposes other than what is sometimes thought of as collation.

Our US-A-4701155 discloses a system in which prints from a printer are conveyed in a series train to an automatic folder which folds each sheet in any of a variety of desired ways, and delivers the folded sheets in sequence into the appropriate bins of a rotating collator. Typically such collator is rotated by a clutch and brake mechanism which advances it one step at a time, so that the open slit-like mouths of the bins move successively into arrested positions for receiving the successive prints. It will be appreciated that if a bin of the collator becomes too full it will not receive additional sheets, and what amounts to a "jam" will be produced if operation is continued.

In the case of ordinary unfolded sheets the problem of predicting over-filling is not so severe, because the thickness and geometry of such a sheet is substantially constant, known, and predictable. However, when some or all of the sheets are folded, and may be folded in different ways and different numbers of times, the problem is mutch more severe; a few multiply-folded sheets, for example, will clearly fill much more space than many more simple unfolded sheets. Accordingly, mere counting of the sheets is not adequate to determine how much space they will require. Measuring the effective thicknesses of the various packets after they have been folded and before they reach the collator is also a difficult, unreliable and costly procedure.

In distinguishing the various folded sheets from each other, the term "panel" is used herein to describe each overlapping layer in a sheet; that is, a single unfolded sheet contains one panel; a sheet folded once contains two overlapping panels; a sheet folded in half, and then folded in half again, contains four overlapping panels; and so on. In this connection, it is noted that a twice-folded sheet of four overlapping panels, for example, generally is in effect thicker than four single unfolded sheets superimposed on each other. In some cases, different parts of a sheet will be folded a different number of times; for example, a sheet may be folded only along one edge region. In such cases the number of panels in the sheet is considered to be the maximum number of overlapping panels present at any location on the sheet, since this is ordinarily what determines the amount of lateral space which it takes up.

In the apparatus of US-A-4701155 referred to above, immediately successive sheets may be folded in widely different ways, so that the problem of avoiding overloading of one or more bins is especially severe.

An earlier patent of ours (US-A-3961781) discloses apparatus for handling and stacking sheets which includes means for sensing the sizes of the sheets but contains no provision for collating sheets into bins to prevent over-filling of the bins.

US-A-4473219 discloses a gatherer for copied papers but contains no provision for avoiding over-filling of bins with sheets which have been folded differently so as to have different thicknesses.

Accordingly, one aim of this invention is to provide a new and useful method and apparatus for distributing sheets into a plurality of bins.

Another aim is to provide such method and apparatus suitable for preventing overloading of said bins by said sheets.

A further aim is to provide such method and apparatus which is adapted to the distribution of sheets at least some of which are folded.

It is also an aim to provide such method and apparatus in which different sheets are differently folded, and overloading of said bins is nevertheless prevented.

Summary of the Invention

These and other aims of the invention are achieved by the provision of apparatus for distributing sheets between bins as defined in the following claim 1 in which the number of superimposed panels in each sheet is sensed and signals are produced which indicate the total effective thickness of all sheets fed to each bin in a first set of one or more bins. When all but one bin is full and the effective thickness for the remaining bin exceeds a predetermined value, a bin-full signal is produced and, preferably, a bin-switching means is then actuated for switching the feeding of said sheets from the first set of bins to a second set of bins exclusive of the one bin. Preferably, the second set of bins is exclusive of the entire first set of bins.

In a preferred embodiment, the apparatus comprises means for assigning differing weighted values to said sheets depending on the number of panels in them, this weighted value being larger for sheets having larger numbers of panels, and the bin-switching means comprises means producing said switching when the sum of said values for the sheets delivered to any bin exceeds a predetermined value. Preferably the number of panels in a sheet is determined by detecting its lateral size, each size of sheet having a known predetermined number of panels when it is delivered to the collator. With this system, switching of the feeding of sheets away from a substantially filled bin is accomplished automatically, despite the feeding of successive sheets having randomly differing numbers of panels.

Preferably also, the system detects the entry of each sheet into the collator, and in response thereto checks the electronic system to determine whether the collector drum should be moved, and where to, e.g. whether a bin is full and if so what bins should not be filled, all such checking and collator drum movement as well as any alarms or other suitable actions being accomplished prior to the arrival of the next sheet.

In one preferred form of the invention, if the number of bins in the first set being filled is N (e.g. 8), and the total number of bins originally available is at least 2N (e.g. 25), then the apparatus operates to feed sheets into the first set of bins until at least one is substantially full, or the assembling of the first complete set of prints has been completed and another job requested, at which time it stops filling of the first set of N bins, determines that a number N of other bins is available, and begins to fill the other set of N bins with sheets thus avoiding over-filling of a bin in the first set.

Brief Description of Figures

These and other aims and features of the invention will be more readily understood from a consideration of the following description, taken with the accompanying drawings, in which:

Figure 1 is a schematic top plan view of a folder-collator system to which the present invention may be applied;

Figure 2 is a side elevational view of the system of Figure 1;

Figure 3 is an enlarged plan view of the inlet to the folder, showing an arrangement of photosensors for sensing the sizes of the sheets being fed to the folder;

Figure 4 is a fragmentary side view of the collator drum of the system of Figure 1, as viewed from the right;

Figure 5 is a similar view of the drum, but as viewed from the left;

Figure 6 is a further enlarged view of the paper-input feed portion of the apparatus shown in Figure 5;

Figure 7 is a schematic functional block diagram of the system of Figure 1;

Figure 8 is a schematic block diagram showing the physical arrangement of the collator electronics for the system of Figure 1;

Figure 9 is a plan view of a printer control panel suitable for use in the system of Figure 1 to control the collator operation;

Figure 10 is a flow diagram illustrating the method of operation of the system of Figure 1 as it relates to the collator;

Figure 11 shows a memory map for the electronics controlling the operation of the collator; and

Figure 12 is a flow diagram for the main loop of the preferred program for the collator electronics.

Detailed Description of Specific Embodiments

Referring now to the embodiments of the invention shown specifically in the drawings by way of example only, and without thereby in any way limiting the scope of the invention, Figures 1 and 2 are the same as those correspondingly numbered and described in the above-identified US Patent specification. Referring to the system shown generally therein, a printer 10, which may be a microfilm-enlarger printer as an example, supplies prints to a folder 12, which folds them appropriately and delivers them to the input of

a collator 14. The output 18 of the printer delivers the prints one at a time in a series train onto an input conveyor 20 for delivery to the input to the folder. A solenoid-operable diverter 22 is provided to enable diversion of the prints to a table 23A beneath the conveyor in the event of a jam-up. The prints slide along the top of a conventional table in the conveyor in response to frictional engagement by the top conveyor belt 23, which extends diagonally so as to urge one side of the prints against a suitable guide wall 95 so they will all be properly aligned.

The folder delivers its folded and unfolded prints upward onto an upper conveyor 24, which moves transversely to the motion of the input conveyor to deliver the prints to the collator. An electrical printer console 25 is provided at the printer to enable the operator to designate the type of folding which he desires, and a cabinet 30 may be provided at the folder to contain the electronics for controlling the folding action. A keypad 31 having three push buttons is provided at the collator, two buttons to enable manual control of forward or reverse operation of the collator drum, and a third button for clearing of the collator circuitry after the sheets have been removed from the collator. A photosensor PS14 is positioned adjacent the inlet to the collator to detect the entering sheets, as also described in more detail hereinafter.

The system includes means for sensing how many overlapping panels are provided in each sheet by the folder. In this example this is preferably done by taking advantage of the fact that, for any general type of folding indicated by the printer console 25, the number of panels produced in the sheet depends upon its size. That is, in the ordinary engineering folding of prints, A-size prints are not folded at all, B-size prints are folded in half once, C-size prints are folded once along a direction parallel to the leading edge of the sheet (parallel-fold) and after that are folded once again in the crosswise direction (cross-fold). D-size sheets are parallel- folded three times and cross-folded once. It is therefore known that A-size prints have one panel, B-size prints have two panels, C-size prints have four panels and D-size prints have eight panels.

The manner in which the sizes of the prints are sensed is shown in Fig. 3, which is the same as Figure 14 of US-A-4701155. This enlarged top plan view of the input conveyor to the folder shows the typical locations of photosensors PS1, PS2, PS3, PS4, PS5 and PS6. From this it can readily be seen that an A-size print in the so-called document orientation reaches the position shown in which it covers PS8 while covering no other photocell. When an A-size in the drawing orientation (long dimension along the conveyor) covers PS8, it also covers PS3. When a B-size print is present, PS2, PS3 and PS6 are all covered, and no others, while for a C-size print PS5 is additionally covered. Similarly, when a D-size print reaches PS6, all of the five photosensors are covered.

In this example, the photosensors are located below the input conveyor table and view the undersides of the prints by "looking" upward through appropriate openings in the table; to this end, the photosensors are preferably so-called reflection-type photosensors in which a beam of light from an LED is directed upwardly toward the prints and, if the print is present, reflection of the light arrives back at the detector element of the photosensor to indicate the presence of the paper. Such devices are well known and commercially available and need not be described in detail.

It will therefore be appreciated that the combination of photosensors PS2-PS8 provides an unambiguous indication of the size of the print, and hence of the number of panels it contains after it passes through the folder. This information is utilized, in accordance with the present invention, to attach a weighted value to each sheet depending upon the number of panels which it contains, this value representing in effect the amount of lateral space which is occupied by the print in a bin of the collator.

The folder 12 may be as described in detail in US-A-4701155.

Table I below contains suitable representative weighting values for each of the differently sizes prints, namely, A, B, C and D. The best values in any particular case are best obtained experimentally for that particular application of the invention. As an example, the weighted value for a once-folded sheet is more than twice that for a single unfolded sheet because, due to the thickness in the region of the fold, it requires more lateral space than two unfolded sheets one upon the other. For other types of folds, and other types of material, these weighting values may be quite different, and can be determined experimentally for any particular application. While the folder shown in the Figures is capable of producing a wide variety of types of folds, those listed above are representative and all of the other possibilities therefore need not be described in detail.

TABLE I

A-size print	1
B-size print	2
C-size print	5
D-size print	7

Figures 4, 5 and 6 show the presently preferred form of the collator mechanism in more detail. It will be seen that it comprises a circular drum 40 divided into 25 radial sector-shaped bins such as 26 by partitions such as 42 extending radially from the axis of the drum. The peripheral faces of the bins provide horizontally extending slits such as 43 through which the successive prints, folded or unfolded, slide into the interior of the bins from the upper conveyor 24 of the folder 12. The rear side of the collator drum is closed by a plate 44, and a removable plastic disc 45 covers the other side of the drum when in use; it is lifted off when the collated or sorted sheets are to be removed. A single magnet arrangement 46 at the center of the disc enables rapid and easy removal and replacement of the cover.

In this example, the collator is rotated on axle 47, one bin width at a time; i.e. with the 25 bins used in this example it is rotated in steps of approximately 15°. Rather than accomplishing this by a stepping motor and gears, it is preferred to utilize a solenoid-operated brake-and-clutch unit 50 of conventional form, whereby the drive motor 52 for rotating the drum 40 is connected through the clutch with the brake off when rotation is to take effect, and is rapidly arrested by opening of the clutch and application of the brake when it is to be stopped preparatory to receiving prints from the folder output. Fig. 6 shows in more detail the roller 52,53 for moving the sheets into the collator, as well as the circumferential belt 55, drive sprocket wheel 56 and idler rollers 57,58 for turning the drum in response to the drum motor. Arresting of the drum at the appropriate position is in this preferred embodiment accomplished by use of sensing means which sense when the collator has rotated to a desired next position and then arresting it as mentioned above.

To this end, a plurality of nuts such as 60 screwed to the ends of bolts such as 62 are provided on rear plate 44, in a circle concentric with the axis of the drum, one such nut and bolt for each bin; preferably each nut and bolt is secured to a flange such as 64, at one side of each bin. A commercial magnetic proximating sensor unit 68 is positioned adjacent the path of the nuts, and is held fixed by bracket 70. Accordingly, each time a nut associated with a bin moves into the appropriate position for receiving a print, the sensor 68 produces a signal on leads 71 which is supplied to the control system for the drum, which in turn supplies an appropriate signal to open the clutch and apply the brake as described above, at the appropriate time to arrest the drum with the appropriate slot such as 43 aligned with the incoming sheet from the folder. Other means of controlling the stepping action of the collator drive may of course be employed instead.

In addition, a reflective type of paper-sensing photosensor PS14 is positioned adjacent to the paper-input guides 74 which guide the sheets into the collator, which produces an output signal on leads 78 when a sheet is entering the collator. Figure 4 shows also the conveyor drive motor and belt 77,77A.

The collator has no fixed reference or home position in this embodiment, from which to count the bins. Instead, upon start-up and initialization of the control system, the bin which is currently facing the folder output becomes, in effect, bin #1 for the duration of the subsequent operations.

Basically, the control system presently to be described in more detail preferably provides a counter for each bin; for example, upon initialization bin #1 is associated with one of the counters which is then designated counter #1, and so forth for the other 24 bins and counters. Each counter maintains a running count of the weighted number of panels of prints contained in its associated bin. Each counter up-counts from its previous count by an appropriate amount in response to signals from the size sensor, acting through the weighting system. The counts accumulated in each counter are periodically compared with a fixed stored count indicative of the level to which any bin can safely be filled, and when one such count reaches the stored count level, action is taken to prevent the collator from exposing that bin to further accumulation of prints.

Figure 7 shows in schematic block form the overall disposition of the collator control system. The collator control electronics 79 are disposed primarily on a collator circuit board unit 80 the physical arrangement of which is shown schematically in more detail in Fig. 8. As shown, it comprises the board 81 supporting an Intel 8040 MCU (micro-controller unit) 82 supplied with operating data from an E-PROM 83, in response to READ instructions from the MCU. The E-PROM is preferably a type INTEL 2764 (8K by 8), utilizing assembly language. An INTEL 8251A UART (Universal Asynchronous Receiver Transmitter) allows exchange of serial data between the printer and the collator. The MCU communicates with Transistor 1 to

control the drum clutch and with Transistor 2 to control the drum brake.

In addition, the circuit board supports an alarm buzzer 86 and a drum-motor reversing relay 87, as well as a motor-controlling TRIAC 88, all controlled by the MCU. A line transformer 90 supplies 220 volt AC power to a power supply 91, which in turn supplies a voltage regulator 92 to produce a regulated 5 volt DC supply voltage for the electronics; two large capacitors 94,95 for the power supply are also mounted on the board.

Figs. 7 and 8 show the inputs to and outputs from the collator circuit board unit. The printer 10 has associated with it a printer console 25 which includes manually-operated controls and communicates with the collator circuit board unit bidirectionally. The photocells PS1-PS6 associated with the folder input conveyor act as sheet-size sensors supplying sheet-size information to the circuit board unit. The collator keypad 31 also supplies input signals to the circuit board, as does the drum position sensor comprising the proximity sensor 68 and the nut assembly described above. Bidirectional communication is also provided between the folder electronics and the collator control electronics, which also supplies control outputs to the drum drive motor and the drum clutch and brake.

Fig. 9 shows one preferred arrangement of the printer console, in so far as it relates especially to the collator operations. Turning on and off of the collator is controlled by push button 96A, and the selection of collate, stack or collect modes is made by means of push buttons 96B, 96C and 96D. The collator status display 96E displays messages COLLATOR READY, or BINS READY, COLLATOR ERROR MESSAGES or COLLATOR JAM, as appropriate. This LCD also displays printer and folder status as well. The paper size to be folded and collated is indicated by operation of pushbutton switches 96F, 96G, 96H or 96I. In the collate mode, the number of sets to be collated is specified by using the keypad 97 to enter the number of sets. Displays 97A and 97B indicate, respectively, the number of sets to be collated in the particular job, and the number of sheets of the set then being collated still remaining to be supplied to the collator on that job. Miscellaneous controls comprise the folder stop and start buttons 98A, 98B, the LOAD PAPER button 98C which tells the system that the operator is going to load sheets into the printer, the AUTOMATIC-MANUAL buttons 98D, 98E which by operation of 98D can switch the printer to a mode in which punch cards are read to instruct the machine automatically with respect to number of sheets, sheet size, collator mode, etc.; this is not part of the apparatus needed for operation according to the present invention. Another set of lamp displays 99A through 99D indicate, by lighting up, that power is on, or that a door accessing the folder mechanism is open, or that one should clear paper from a jam, or that the operator should check the display 96E for an appropriate message.

A broad flow diagram of the control system for the collator is shown in Fig. 10, which is also equivalently a "hard-wire" block diagram, although in this embodiment system operation is preferably implemented and controlled by software in an E-PROM.

Turning now to Figure 10, the collator drum is represented at 40, with its ring of nuts 60 and its proximity sensor unit 68; control of the direction and extent of motion is indicated by the line 100 shown schematically as acting on the axle of the drum. The previously-described paper size sensor provides the SENSE PAPER SIZE step shown at 102, the printer control panel provides the GENERATE PRINT-MODE COMMAND step shown at 104, and the SENSE DRUM POSITION 108 step is provided by suitable conventional electronics responsive to the output of the sensor unit 68. The CONTROL DRUM POSITION 112 function is performed by the clutch, brake, motor and motor reverse units and associated electronics, responsive to the GENERATE PRINT-MODE COMMAND, SENSE DRUM POSITION, and GENERATE MOVE TO NEW POSITION COMMAND steps to be described hereinafter.

As shown, the result of SENSE PAPER SIZE enables the step indicated as GENERATE WEIGHTED VALUES DEPENDENT ON NO. OF PANELS TO BE FORMED. These weighted values may be as given in Table I above. From these values, the step labelled STORE BIN COUNTS REPRESENTING TOTAL WEIGHTED VALUES FOR EACH BIN is enabled. These stored bin counts are sampled, as indicated by the step labelled SAMPLE BIN COUNTS, and the result of the sampling is used to COMPARE SAMPLED BIN COUNTS WITH REF COUNT #1. The latter reference count is stored for this purpose, as indicated by the step STORE FIRST REFERENCE COUNT #1.

The first reference count #1 is a value such that a bin will be nearly full when it has been supplied with sheets having a total weighted value equal to or slightly greater than the first reference count #1. As shown in Fig. 10, a step is provided designated IF A BIN COUNT IS GREATER THAN REF. COUNT #1, SEND "BINS FULL" SIGNAL TO PRINTER (24 bins are full, 25th bin almost full). This enables the printer to produce a BINS-FULL indication as by lighting a lamp, or sounding an alarm.

In this embodiment of the invention, the occurrence of such a BIN-FULL signal does not mean that the last, 25th bin in question is completely full; there is still some room in the bin for further sheets. In a typical case, there will still be room for three more D size drawing prints, as a margin for safety against over-filling

and resultant jamming and destruction of later-arriving sheets.

In this preferred embodiment the remainder of the process shown in Fig. 10 serves to detect the condition of complete fullness of a bin, to provide indications of when this occurs, to search for an available set of empty bins, and to switch the distribution of sheets from the original set of empty bins to a new set of bins if they are available. If such a new set of empty bins is not available, a signal so indicating is sent to the printer.

Referring again to Fig. 10 then, the procedure shown is to STORE SECOND REFERENCE COUNT #2, which count #2 may for example exceed Count #1 by 27 (the weighted bin value for three D-size prints). The next step is COMPARE SAMPLED BIN COUNT WITH REF. COUNT #2; when and if a weighted bin count exceeds reference count #2, a DETECT EMPTY BINS step is performed, acting on the samples resulting from the SAMPLE BIN COUNTS step. The number of available empty bins thus detected is compared with the number needed, by the step designated COMPARE NO. OF EMPTY BINS WITH NO. OF BINS NEEDED; the latter number is obtained by a step designated STORE NO. OF EMPTY BINS NEEDED, which storage is accomplished in response to the print-mode command.

If the number of empty bins is less than the number needed for the collator mode being performed (number of prints exceeds available space in collator), then a SEND MESSAGE TO PRINTER step is performed (Status 5 message), to so notify the printer, which may respond by producing a distinctive visual and/or audible alarm or by automatically shutting off the printer.

If an empty set of bins of sufficient number is detected, then the step GENERATE MOVE TO NEW POSITION command is issued to control the drum position so that it presents a new empty set of bins to receive further distribution of the overflow of sheets which are beyond the capacity of the original set of bins. This operation will repeat if the second set of bins becomes completely filled, and so on until there is no longer a large enough empty set available and the SEND MESSAGE TO PRINTER step so informs the printer.

While the invention may be embodied in relatively simple apparatus and using a relatively simple program, the following will describe a specific embodiment which has actually been constructed. First there will be described the communication modes used in the preferred system and the status messages sent between printer console and collator electronics, then the operation of the programmed system, and finally a specific assembly-language program for the system will be provided.

COMMUNICATIONS MODES

The system operates in any selected one of five different primary communications modes which affect and determine the manner in which the sheets are distributed to the collator, as follows:

MODES OF COMMUNICATION

MODE 1 - COLLATE At the printer, the operator operates pushbuttons to select the COLLATE mode, the number of prints to be collated and the number of sets of prints desired. This causes reset of the counters, loads the "number of sets" into a register, and starts the collate action. The first print is distributed to the bin first presented, the next to the next adjacent bin, and so on until the number of sets of prints selected at the printer control panel has been reached (25 maximum in this example). The drum is then indexed automatically in the opposite direction, step by step, placing a second print in each bin until it has returned to its original position. This scanning back and forth continues until an END OF JOB signal from the printer is produced by information inserted at the printer control panel as to how many sheets were to be collated.

MODE 2 - STACK At the printer, the operator selects this mode and the number of prints desired per set. This resets the counters, loads the "number of prints per set" into a register, and starts the STACK operation. The system then operates to place the selected number of consecutive prints in the originally-presented bin, then indexes to the next bin, distributes the same number of prints to that bin, and so on until the preselected number of prints/set has been placed in an specified number of bins and an END OF JOB message has been generated and distribution terminated.

MODE 3 - COLLECT The operator selects this mode and the total number of prints to be collected, which information is immediately transmitted to the collator electronics. This resets the counters, loads the "total number of prints" into a register, and starts the COLLECT operation. All prints are delivered to the initially-presented bin until it is substantially full, or the selected number of prints, as indicated by the END OF JOB signal, has been received, whichever occurs first. The collator drum will index to the next bin if the manual pushbutton at the collator keypad is operated, or if a FULL BIN, FULL COUNT or END OF JOB

message is generated.

MODE 5 - SPECIAL By operating a manual input (not shown) at the printer console, the operator may indicate which bin is to receive a print; for this purpose the bins may be visually identified, as by marking them with numbers. The resultant manually-generated data identifying the selected bin are entered into a FIFO (first-in, first-out) buffer at the collator, each print is received by the collator, and its identifying data is removed from the buffer and sent back to the printer as a STATUS 7 message. The printer sends an END OF JOB message to the collator to complete performance of the SPECIAL mode. At this time a STATUS 3 message (END OF JOB) message is sent to the printer. The collator will align Bin #1 with the folder paper exit for operator reference of bin locations.

MODE 10 - FILL THE BIN This is similar to COLLECT mode, except that it ignores any END OF JOB message, and continues to fill each bin, moving to the next bin when the present bin has been filled. This continues until all bins are full or some other mode is selected. This is the default mode, occurring after a reset, or upon power-up of the system, or when the collator completes all other jobs.

In the preferred embodiment, the collator electronics also checks, when possible, to see that the actual number of prints reaching the collator drum on a specific printing job is the same as the total number of prints produced by the printer for that job. The collator electronics then checks to determine if an END OF JOB message was received; if so, the collator electronics will signal the printer with a STATUS 3 message (END OF JOB) and turn on an alarm buzzer for two seconds, for example, indicating that the job is completed.

The collator will automatically index to the next available empty bin when a job is complete. The inception of a new COLLECT, STACK or COLLATE mode causes automatic indexing to the next empty bin, if the current bin is not empty; as mentioned above, in the COLLATE mode the system checks to see that enough empty bins are available to receive the number of sets of prints which are to be collated.

When completing one mode and beginning another, the collator will treat the bins utilized in the previous mode as "full" bins (i.e. not empty) and as not available to receive additional sheets even though they are not necessarily full physically. However, when the sheets have been removed from the collator by the operator, it will be desirable to use these same bins again. This is enabled by the operator operating the CLEAR button at the collator keypad when the prints have been removed; or, a RESET (MODE 9) message from the printer to the collator will allow all bins to become available to the sheets from the printer.

In addition, there are four other modes, namely modes 4, 7, 8 and 9, which do not directly determine the handling of the sheets by the collator, but enable certain support functions, and which are as follows:

MODE 4 - CONTINUE This serves to reset the "collator stopped" bit. More particularly, this mode resets the COLLATOR STOPPED bit B2 in register R2, sets the transmit bit B1 in register R2 and sets bit B6 in the "status" register to indicate COLLATOR RUNNING.

MODE 7 - COUNT ONE PRINT This is produced by the printer to indicate that a print is being sent by the printer. A count total is accumulated in a register R5 to keep track of any prints remaining in the portion of the system preceding the collator drum. The contents of the register R5 may then be used as a count checker.

MODE 8 - END OF JOB This is sent by the printer immediately after the printer starts its last set of prints of the current job - for example, if the command is "STACK 2", it sends a message when 2 prints are yet to be sent. It is used as a means of terminating one of modes 1-3 or 5. Bit 4 in register R2 is set to signal the collator that the END OF JOB signal has been sent to the collator.

MODE 9 - RESET (same as POWER-ON RESET) This occurs in response to turning on of the power for the complete equipment. It clears counters, defines the currently-presented bin as bin #1, and enables the FILL THE BIN MODE 10.

STATUS MESSAGES, COLLATOR TO PRINTER

In the preferred embodiment, any change of status will produce a status message to the printer containing all appropriate information. For example, if a count error occurs at the end of a job, the message will contain STATUS 0 (i.e. COLLATOR STOPPED), STATUS 3 (END OF JOB), and STATUS 4 (COUNT ERROR).

The nine status messages are as follows:

STATUS 0 - COLLATOR STOPPED This status is produced no matter why the collator is stopped, as by occurrence of an error condition (such as BINS FULL, JAM or other).

STATUS 1 - READY (Bins Empty) This status is set when an operator empties the bins and pushes the CLEAR pushbutton at the collator keypad. It is also set by a RESET MODE 9 message from the printer. The register R2, bit B6 is cleared as soon as a print is received at the collator.

STATUS 2 - 25 BINS FULL This status is set when the collator determines that there is no empty bin left. It is discussed in more detail at the end of this list of statuses.

STATUS 3 - END OF JOB This status is set when the actual number of prints received at the collator drum equals the desired number of prints pertaining to that job and an END OF JOB message has been received from the printer. This status is cleared by sending it to the printer, or by reset (MODE 9).

STATUS 5 - QUANTITY ERROR 1 This status is set when the number of prints sent by the printer in MODES 1, 2 or 3 exceeds the available space in the collator or is larger than a predetermined reference quantity. This status is not retained; it causes a message to be sent to the printer, and the printer message which caused the error is obviated or ignored.

STATUS 6 - QUANTITY ERROR 2 This status is set if the message representing the number of prints sent by the printer is not a valid ASCII number. This status is not retained; it causes a message to be sent to the printer and causes the message which contained the error to be ignored.

STATUS 7 - SPECIAL This status is set to produce a response from the collator indicating that a print sent in the SPECIAL MODE 5 has been received by the collator.

STATUS 8 Not used.

STATUS 9 - COLLATOR RUNNING In the absence of any other appropriate status information, this message indicates that the collator system is functioning properly.

Regarding STATUS 2 - BINS FULL, if all bins are full a momentary audible alarm is produced and the collator stopped. The occurrence of a BINS-FULL condition in the COLLATE MODE causes the collator automatically to check the bin-count registers for a set of consecutive empty bins large enough in number to receive the number of sets being collated.

Before the collator is completely full, it will monitor the remaining bin space, as well as monitoring the number of prints present in the system pipeline between the printer and the input to the collator drum by comparing the COUNT 1 PRINT total with a count of prints which have entered the collator drum. When the number of prints in the pipeline is sufficient to completely fill the collator, the collator sends a STATUS 2 - BINS FULL and a STATUS 0 - COLLATOR STOPPED message to the printer; the buzzer alarm will then go on for two seconds. The collator assumes that each print in the pipeline is of maximum thickness, e.g. a D-size print in this embodiment.

COLLATOR MEMORY MAP

Fig. 11 is as schematic memory map showing the address locations, in the MCU RAM, of the stored bytes and bits relating to the principal operations performed by the preferred program listed in detail at the end of this specification. In that drawing, the 8-bit byte locations are specified in the left-hand column by hexadecimal numbers extending from 00 at the bottom to FF at the top. The lowermost group of locations 00H to 07H are for the bytes R0 to R7. R0 and R1 are general purpose registers; R2 (at 02H) is the flag register, the eight bits of which represent the bit information indicated at the right thereof. R3 (at 03H) is another general purpose register. R4 (at 04H) is the GIVEN PRINT COUNT register.

R5 (at 05H) is the register for COUNT 1 PRINT, i.e. the accumulated count of prints leaving the printer. R6 (at 06H) contains the BIN COUNT (the numbers assigned to the bins, i.e. 1 to 25). R7 (at 07H) contains the ACTUAL PRINT COUNT, i.e. the number of prints reaching the collator during the job.

As noted in Fig 11, when operating in SPECIAL MODE 5, R4 contains the numbers of the bin to which a print is to be supplied.

Memory locations 08H to 17H are the memory storage bytes for the sub-routines and interrupt routine for the microcontroller INTERNAL STACK.

The next set of memory locations 18H to 1FH contains the following: R0' and R1' are general-purpose registers; R2' is the MODE register, storing the number of the selected mode; R3' is the MESSAGE BUFFER REGISTER; R4' is the COMMUNICATIONS STATUS REGISTER; R5' is the PRINT RECEIVER POINTER register; R6' is the COLLATOR TRANSMIT pointer register; and R7' is another general purpose register.

R4' of this group of memory location registers contains the eight bits of information identified at the right of R4' in Fig. 11, as follows: B0 indicates a PRINTER ORIGINATED MESSAGE, indicating that such message exists; B1 represents FLAG IN INTER- RUPT; B2 is not used; B3 represents TRANSMIT IN PROGRESS; B4 represents COLLATOR ORIGINATED MESSAGE; B5 is not used; B6 represents CHARACTER ECHOED COMPLETE; and B7 represents TRANSMIT ECHO ERROR. These bits of R4' are primarily for conventional housekeeping with respect to handling of serial communications between collator and printer.

Bytes 20H to 30H are for the storage of printer-originated messages, and bytes 30H to 40H for the storage of collator-originated messages.

41H to 59H include 25 locations for the weighted bin values for bins 1-25 respectively.

5AH to 9AH comprise 64 locations used for general RAM, including a byte at 7CH where the following message flags are located: B0 = BINS FULL, indicating that there are no empty bins available; B1 = END OF JOB. B3 is QUANTITY ERROR #1, B4 is QUANTITY ERROR #2, and B6 is COLLATOR RUNNING, all explained elsewhere herein. B5 is a SPECIAL bit indicating that a STATUS 7 message to printer is required.

Locations 9BH to CEH inclusive are locations for information used in MODE 5 - SPECIAL.

DETAILS OF PROGRAMMED OPERATIONS

The preferred programming for the system responds to two basic events; the first is a message or messages from the printer electronics requesting action by the collator electronics. The handling of such requests is designated as MODE HANDLING. The other basic event is a signal indicating that a sheet is entering the collator from the folder, which triggers the action in response to the printer request, except for the Default MODE 10 which occurs automatically upon power-up of the equipment. When a printing job is initiated, an empty bin confronts the folder output, so that no special action is necessary for this first sheet. However, when the first sheet enters the collator, PS14 provides a signal indicating this and, if necessary, initiates action to position the collator drum properly to receive the next sheet, and so on for subsequent sheets. This action, triggered by each sheet entering the collator drum, is designated as MODE APPLICATION.

Before considering the MODE HANDLING and MODE APPLICATION operations per se, the main programmed loop will be considered briefly; it does not do any real, physical or detailed work. Basically, it is as shown in the flow diagram of Fig. 12.

As will be seen from that Figure, following initialization the system operates to check whether its motor should be on or off and then checks paper entry into the drum. If the result is a YES, the system checks whether the collator is running and there is no paper jam; if "YES", the system enters the MODE APPLICATION cycle, described in detail hereinafter; at the end of MODE APPLICATION the system returns to CHECK F1 SET. If the collator is not running or there is a jam, the system goes directly to CHECK F1 SET, and does not enter MODE APPLICATION.

If CHECK PAPER ENTRY shows no sheet at the entrance to the collator drum (a NO), the system goes directly to CHECK F1 SET, which is a flag internal to the MCU but available to the programmer, indicating a new message from the printer. If this flag is set, the system enters its MODE HANDLING sequence, described hereinafter. When MODE HANDLING is complete, the system checks for a RESET flag (Bit 5, R2 at 01H of the collator memory map). If the F1 flag is not set, the system bypasses MODE HANDLING and goes directly to CHECK RESET FLAG.

If the RESET flag is set, the system disables its interrupt and jumps directly to the very beginning of the program, prior to INITIALIZATION, and the cycle repeats. However, if the RESET flag is not set, the system calls up a keypad sub-routine, which determines whether Forward, Reverse or Clear buttons have been depressed at the collator keypad and performs the selected function, if any.

The system then proceeds to determine whether the TRANSMIT flag is set. If not, the program goes to the beginning of the main loop, just prior to CHECK PAPER ENTRY; if the TRANSMIT flag is set, a message stored in a buffer will be sent from collator to printer, after which the system returns to CHECK MOTOR STATUS.

MODE APPLICATION - "NON-PAPER" MODES

The MODE APPLICATION process responds to MODE 4 - CONTINUE, MODE 7 - COUNT ONE PRINT, MODE 8 - END OF JOB and MODE 9 - RESET, which do not directly determine how the sheets are distributed into the collator; for this reason they are designated as "non-paper" modes and operate as follows:

MODE 4 - CONTINUE resets the "collator stopped" bit, B2, in register R2, sets the transmit bit B1, in register R2, and sets bit B6 in the "status" register to indicate the "collator is running". No other pointers or registers are altered.

MODE 7 - COUNT ONE PRINT is sent from the printer every time a print of any size leaves the printer. Therefore, the collator uses a register, specifically R5 at 05H of the memory map, to count the number of "COUNT ONE PRINT" messages received pertaining to a specific mode (paper mode). R5 is then used as a count checker.

MODE 8 - END OF JOB message is sent from the printer after however many "COUNT ONE PRINT" messages have been sent from the printer. It is used as a means of termination of one of the paper application modes as described later. Bit B4 in register R2 (at 02H) is set to signal the collator that the "END OF JOB" message has been sent to the collator.

MODE 9 - RESET message also sets a bit in this same register R2, specifically B5. This flag is looked at only in the main loop routine. No other pointers or registers are altered.

The so-called "paper" MODES 1, 2, 3 and 5 which directly control the nature of the distribution of the sheets to the collator drum operate generally as follows:

MODE 1 - COLLATE also receives the number of sets of prints in its message from the printer, representing the number of sets to be formed. The collator system software first checks to see if the number of sets of prints is greater than 25. If it is greater than 25 an error exists since there are only 25 possible bins in which to place paper. Bit B4 of the "STATUS" register (at 7CH) is then set to indicate a "QUANTITY TWO ERROR", as is bit B6 ("COLLATOR RUNNING"): the default mode 10 is in operation and bit B1 in register R2 is set to "TRANSMIT MESSAGE". If the number of sets of prints is 25 or less, the system software then checks to see if there is a set of consecutive empty bins equal to the number of sets of prints received in the message. If this cannot be done, bit B3 of the "STATUS" register is set indicating a "QUANTITY ONE ERROR" and so is B6. Again bit B1 in register R2 is set, and the default mode 10 is placed in operation. If there are a set of consecutive empty bins available equal to the number of sets of prints, the software will enable the collator drum clutch to advance the collator drum in the forward direction until the first empty bin of the set is aligned with the drum slot or paper opening and then will disable the clutch and enable the brake. Several registers are then reset, namely: R5-COUNT ONE PRINT and R7-ACTUAL PRINT COUNT.

Some registers are preset, namely:

R2-Bit B6, BINS EMPTY, remains as it was, all other bits are reset.

FLAGS-(same as "STATUS" register), Bit B6, "COLLATOR RUNNING", set, all other bits reset.

R6-equals BIN COUNT or number

R4-equals number of sets of prints

R2'-(' indicates register bank 1, RB1) equals the mode (Fill Bin, Collate, Stack, Collect or Special – in this case, Collate).

MODE 2 - STACK receives the number of prints/set in its message from the printer. The first topic to be addressed by the collator system software is the availability of 1 empty bin. If 1 empty bin cannot be found, bits B6 and B3 in the "STATUS" register are set indicating "COLLATOR RUNNING" and "QUANTITY ONE ERROR", respectively. Also bit B1 of register R2 is set to "TRANSMIT MESSAGE", and mode 10 is placed in operation. If an empty bin is available, the software enables the clutch and advances the collator in the forward direction until the slot or paper opening is aligned with the first available empty bin. The clutch is then disabled and the brake enabled. The registers affected in MODE 1-COLLATE are also affected in MODE 2-STACK in the exact same fashion, except that R4 now represents prints per set.

MODE 3 - COLLECT receives the total number of prints to be printed, instead of the number of prints/sets, in its message as compared to MODE 2. However, as far as MODE HANDLING is concerned, MODE 3 is identical to MODE 2 except that the "total number of prints" is placed in register R4.

MODE 5 - SPECIAL is unique in that a specific bin number is sent within the message from the printer (as paper enters the collator the software will reposition the collator to the next bin specified in the special message). MODE HANDLING of the SPECIAL mode begins by checking to see if the bin number specified in the message is less than or equal to 25, since there are only 25 bins on the collator. A value greater than 25 results in a "QUANTITY TWO ERROR", bit B4 being set along with B5, and "SPECIAL" being set in the "STATUS" register. Also, bit B1 of register R2 is set to "TRANSMIT MESSAGE". If the bin number is valid, a check is then made to determine whether or not the bin is full. If the bin is full, bits B6 "COLLATOR RUNNING", and B3 "QUANTITY ONE ERROR" are set in the "STATUS" register. Also, bit B1 of register R2 is set to indicate "TRANSMIT MESSAGE". If the specified bin is not full, the collator system software then determines whether or not this is the first message in MODE 5. If it is, two pointers are set equal to each other. These pointers are utilized to keep track of consecutive MODE 5 messages. In all likelihood there will exist many more MODE 5 messages than there will MODE 5 prints in the collator. For this reason, one of the two pointers will point to the last bin number sent in the MODE 5 messages while the other pointer will point to the bin number in which the collator has received print while in MODE 5. This rationale makes it clear that one pointer will be incremented each time a MODE 5 message is received while the other pointer is incremented each time a MODE 5 print is received (until the job is completed). If this message is the first or only MODE 5 message and the bin is not full, the software will determine the shortest distance to rotate the collator to align the desired bin number and move the collator in the correct

direction to the desired bin number; this also occurs with subseuent special messages. Bit B7 of register R2 is set to indicate "MODE 5". Also bit B0 of the "STATUS" register is reset ("BINS FULL") since a bin was found not to be full. No other pointers or registers are altered.

MODE 10 - FILL THE BIN is the default mode which is in operation on power-up, and after error conditions described above are found, and after all other jobs are completed.

MODE APPLICATION -"PAPER" MODES

Prior to describing the various "paper" modes in detail, some data manipulation which has to be performed by the collator system software will be described. Once paper enters the collator the weighted value of the paper is added to the total weight of the specific bin. This weighted value of the bin is then compared to a predetermined value which is exactly 3 D size prints less than a full bin if 24 bins are full; otherwise this weighted value of the bin is compared to a second predetermined value which represents a full bin.

MODE 1 - COLLATE starts by determining whether or not the motor direction is forward or reverse. If the direction is forward then "DIRECTION COUNTER" register, initially cleared to zero, is incremented. A comparison is then made between the "DIRECTION COUNTER" register and R4, which contains the number of sets of prints. If these two registers are not equal the bin number register R6 is incremented and the motor moves the collator one bin position in the forward direction before returning to the main loop. If the "DIRECTION COUNTER" register and R4 are found to be equal then R7, actual print count register, is reset to zero, the "MULTIPLE" register is incremented, initially cleared to zero, a check is then made to determine if an "END OF JOB" message has been received. If it has, a comparison is made to determine if the total number of prints received by the collator pertaining to the COLLATE mode is equal to the expected number of prints to be received. If this is also true, then the alarm buzzer is turned on for two seconds, the "DIRECTION COUNTER" and "MULTIPLE" registers are reset, and all used bins are recognized as full bins.

Following the same scenario but with the "END OF JOB" message not received, the determination is then made to see if the bin is full. If it is not full, the motor direction is opposite of what it was previously, and then a return is made to the main loop. If the bin was found to be full, the "DIRECTION COUNTER" register is reset and a search is made to find a second set of bins.

If the motor direction was found to be reverse (implies that collator has already received a set of prints due to initialization routine which places motor in forward direction), then a check is made to determine if the "DIRECTION COUNTER" register is equal to zero. If it is not equal to zero (starting bin in collate mode), then R6, bin number register, is decremented and the collator reversed one bin position. If "DIRECTION COUNTER" register is equal to zero then the flow follows the same as if the "DIRECTION COUNTER" register had equalled R4 above.

MODE 2 - STACK application software is only utilized when the "ACTUAL PRINT COUNT" register, R7, becomes equal to the "GIVEN PRINTS/SET COUNT" register R4. R7 is then reset and the "MULTIPLE" register is incremented. A check is then made to determine if an "END OF JOB" message has been received. If it has been received, a check is then made to determine if R4 times the "MULTIPLE" register will equal the total number of prints expected to be received by the collator for stack mode. If this comparison is not equal, the collator will move in the forward direction to the first available empty bin. A return to the main loop is then performed. If all the prints expected to be received by the collator were in fact received, then the job is considered to be finished. The alarm buzzer goes on for two seconds, the "MULTIPLE" register is reset to zero, bits B1 of register R2 are set to transmit a message, and the bins used are considered to be full and a return to the main loop is performed.

MODE 3 - COLLECT is very similar to STACK and uses the exact same software routines. The significant difference here is that the collator does not expect the "MULTIPLE" register to ever become greater than one, due to the definition of COLLECT. Therefore, there exists no need for the collator to search for additional empty bins unless the bin becomes physically full.

MODE 5 - SPECIAL must first prepare to transmit a message to the printer indicating that a "SPECIAL" print has been received. This message also includes the bin number in which the print was inserted. Once this is completed the collator system software checks to see if the two pointers mentioned in MODE HANDLING "SPECIAL" mode are equal to one another, and if they are, a check is then made to see if an END OF JOB message has been received. If an END OF JOB has not been received, it is assumed that more SPECIAL messages are yet to come and therefore nothing is yet altered. If the two buffers are not equal to one another, the collator system software gets the next bin number in the buffer referenced by one of the pointers in which the next MODE 5 print should be placed, at the same time incrementing that

pointer. The shortest route to this bin is determined, the motor direction is then determined, and the clutch is enabled until the particular bin is aligned with the paper slot, at which time the clutch is disabled and the brake enabled. Once the two pointers become equal and an END OF JOB message has been received, then the job is considered complete. The two pointers are then reset, all MODE 5 - SPECIAL bin numbers used are considered full bins, bit B1 of R2 is set (TRANSMIT MESSAGE), the motor direction bit B0 is left intact, and bits B2-B7 are all reset in register R2. Bits B1, B5, and B6 are all set in the "status" register. They are END OF JOB, SPECIAL and COLLATOR RUNNING, respectively. The alarm buzzer is then turned on for a short period of time (approximately two seconds) and then turned off. No other registers or pointers are altered.

Serial communications between the collator and printer need not be described in detail here. However, it should be pointed out that an interrupt will occur whenever the collator UART (Universal Asynchronous Receiver Transmitter) receives a character. The collator system software is set up so that it can determine whether or not the character received is from a message that the printer is originating or an echoed character from a message that the collator had originated.

Accordingly, while the invention has been shown and described with particular reference to specific preferred embodiments thereof, it will be understood that it may be embodied in a variety of forms diverse from those specifically shown and described, without departing from the scope of the following claims.

Claims

1. A sheet-distributing apparatus (40) comprising a plurality of bins (26) for receiving and storing sheets of material some or all of which may be folded one or more times, and means (20,24) for feeding said sheets to said bins, characterised by:

   sheet-sensing means (PS2-PS6) for sensing the number of superimposed panels in each of said sheets prior to feeding them to a first set of said bins (26) and for producing signals representative of the effective total thickness of the sheets fed to each of said bins; and

   bin-switching means (112,52) responsive to said signals for switching said feeding of said sheets from said first set of bins (26) to a second set of said bins (26) when one of said bins of said first set has become substantially filled with said sheets.

2. The apparatus of Claim 1, characterised in that said second set of bins (26) is completely exclusive of said first set of bins.

3. The apparatus of Claim 2, characterised in that said first set of bins (26) comprises less than one-half the total number of bins of said apparatus (40) and said other set of bins is exclusive of said first set of bins and equal thereto in number.

4. The apparatus of Claim 3, characterised in that said sheets of material fed to said bins (26) comprise a train of separate integral sheets different ones of which have different numbers of overlapping panels.

5. The apparatus of Claim 1, characterised in that said sheets fed to said bins (26) comprises a train of separate integral sheets differing ones of which have different numbers of overlapping panels; said means for sensing the number of said panels for each sheet comprises means (102) for producing first signals indicating the number of overlapping panels in each of said sheets; and said bin-switching means (112,52) comprises means for assigning different values to said sheets depending on the number of said overlapping panels therein, with greater values assigned to sheets having greater numbers of panels and means for producing a bin-switching signal (100) when the sum of said values for sheets supplied to any of said first set of bins (26) reaches a predetermined level.

6. The apparatus of Claim 1, characterised in that the total number of said bins (26) is at least twice the number of bins in said first set, and said bin-switching means (112,52) is responsive to said sheet-sensing means (102) to switch said feeding of said sheets from said first set of bins (26) to a second set exclusive of said first set and equal in number to said first set.

7. The apparatus of claim 1 having, in combination, a sheet folder (12) and a sheet collator (14) for automatically receiving a series of sheets of material from the folder (12) in bins (26) of the collator (14), said sheets entering said folder differing in lateral size and being folded differently by said folder to produce different numbers of superimposed panels in the sheets exiting from said folder depending

upon the lateral size of the sheet prior to its folding:

characterised by apparatus for signalling when a bin (26) in said collator (14) has been filled with said sheets to a predetermined degree, said apparatus comprising

first means (102) for producing first signals indicative of the lateral size of each sheet prior to its folding;

second means responsive to said first signals for producing second signals having values representative of the number of superimposed panels to be formed in each sheet by said folder, said weighted value for each sheet increasing with the number of said panels to be formed in said each sheet; and

third means responsive to said second signals for producing third signals indicative of when the sum of said values for sheets delivered to any one of said bins (26) attains a predetermined reference value corresponding to said predetermined degree of fullness of said one bin.

8. The apparatus of Claim 7, characterised by

fourth means responsive to said third signals for determining whether there is another bin (26) of said collator (14) which is not filled to said predetermined degree, and for switching delivery of said sheets away from said one bin to another bin.

9. The apparatus of Claim 7, characterised by collator control means (112) for presenting a first set of N bins to receive distribution of said sheets from said folder (12), means responsive to said third signals for detecting the existence of another set of N different bins in said collator which are not filled to said predetermined degree, and means responsive to said third signals for switching the distribution of said sheets from said first set of N bins (26) to said other set of N bins (26).

10. Method of distributing successive groups of sheets of material serially to a first plurality of storage bins (26) according to a predetermined desired distribution pattern for each group when using the apparatus of claim 1,

characterised by monitoring the quantity of sheets delivered to each of said bins (26) to develop first signals representative thereof;

in response to said first signals, storing in a plurality of signal-storage registers a corresponding plurality of values representative of the quantity of said sheets delivered to corresponding respective sheet-storage bins (26);

generating second signals representative of said desired distribution patterns;

applying said second signals to control said distribution of sheets to said bins according to said distribution patterns;

prior to distributing said sheets of each of said groups to said bins, checking said values then in said storage registers to identify a set of bins appropriate to receive said each group of sheets and to produce third signals indicative of the location of said set of bins; and

controlling said distributing in response to said third signals to effect delivery of each of said groups of sheets to a corresponding appropriate set of bins.

11. The method of Claim 10, characterised in that different sheets of some groups have different numbers of superimposed panels, and said method comprises producing fourth signals indicative of the total number of panels in the sheets delivered to each bin and producing fifth signals indicative of when said total number of panels exceeds a predetermined reference value for any of said bins.

12. The method of Claim 11, characterised by determining whether another plurality of bins (26) are available to receive additional sheets when said fifth signal is produced, and if so, thereafter switching the distribution of sheets from said first plurality of bins to said other plurality of bins.

13. The method of Claim 12, characterised by producing a sixth signal in the event that said determining shows that another plurality of bins is not available.

14. The apparatus of Claim 5, characterised in that said bin-switching means comprises sheet-detecting means (PS14) for detecting the entrance of each sheet into said collator (14) to produce a sheet-entry indicating signal, and means (80) responsive to said sheet-entry indicating signal for producing a further signal indicating whether the immediately succeeding sheet will over-fill a bin of said collator (14).

15. The apparatus of Claim 14, characterised in that said bin-switching means comprises means responsive to said further signal for determining whether said bin-switching means should be actuated to prevent over-filling of said collator.

Patentansprüche

1. Bogenverteilungsvorrichtung (40), die eine Mehrzahl von Behältern (26) zur Aufnahme und Lagerung von Materialbögen, von denen einige oder alle ein oder mehrere Male gefalzt sein können, und ein Mittel (20, 24) zum Zuführen dieser Bögen zu den Behältern umfaßt, gekennzeichnet durch
ein Bogenerfassungsmittel (PS2 - PS6) zur Erfassung der Anzahl übereinanderliegender Lagen bei jedem der Bögen, bevor sie einem ersten Satz Behälter (26) zugeführt werden, und zur Erzeugung von Signalen, die die effektive Gesamtdicke der jedem der Behälter zugeführten Bögen darstellen, und
ein auf diese Signale reagierendes Behälterumschaltmittel (112, 52) zum Umschalten der Zufuhr der Bögen von dem ersten Satz Behälter (26) auf einen zweiten Satz Behälter (26), wenn einer der Behälter des ersten Satzes mit den Bögen wesentlich gefüllt worden ist.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß der zweite Satz Behälter (26) den ersten Satz Behälter in keiner Weise umfaßt.

3. Vorrichtung nach Anspruch 2, dadurch gekennzeichnet, daß der erste Satz Behälter (26) weniger als die Hälfte der Gesamtanzahl der Behälter der Vorrichtung (40) umfaßt und daß der andere Satz Behälter den ersten Satz Behälter nicht umfaßt und die gleiche Anzahl wie er aufweist.

4. Vorrichtung nach Anspruch 3, dadurch gekennzeichnet, daß die den Behältern (26) zugeführten Materialbögen eine Folge separater vollständiger Bögen umfassen, von denen verschiedene eine unterschiedliche Anzahl von sich überlappenden Lagen aufweisen.

5. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die den Behältern (26) zugeführten Materialbögen eine Folge separater vollständiger Bögen umfassen, von denen verschiedene eine unterschiedliche Anzahl von sich überlappenden Lagen aufweisen; das Mittel zur Erfassung der Anzahl dieser Lagen für jeden Bogen ein Mittel (102) zur Erzeugung erster Signale umfaßt, die die Anzahl von sich überlappenden Lagen bei jedem der Bögen angeben; und das Behälterumschaltmittel (112, 52) ein Mittel zur Zuordnung verschiedener Werte an die Bögen je nach Anzahl der sich dabei überlappenden Lagen, wobei Bögen mit einer höheren Anzahl von Lagen größere Werte zugeordnet werden, und ein Mittel zur Erzeugung eines Behälterumschaltsignals (100), wenn die Summe der Werte für einen beliebigen des ersten Satzes Behälter (26) zugeführte Bögen eine vorbestimmte Höhe erreicht, umfaßt.

6. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Gesamtanzahl der Behälter (26) mindestens doppelt so hoch ist wie die Anzahl von Behältern im ersten Satz, und das Behälterumschaltmittel (112, 52) auf das Bogenerfassungsmittel (102) reagiert, um die Zufuhr der Bögen von dem ersten Satz Behälter (26) auf einen zweiten Satz, der den ersten Satz nicht umfaßt und die gleiche Anzahl wie er aufweist, zu schalten.

7. Vorrichtung nach Anspruch 1, die eine Kombination aus einer Bogenfalzvorrichtung (12) und einer Bogenzusammentrageinrichtung (14) zur automatischen Aufnahme einer Reihe von Materialbögen von der Falzvorrichtung (12) in Behältern (26) der Zusammentrageinrichtung (14) aufweist, wobei sich das Seitenmaß der in die Falzvorrichtung eintretenden Bögen unterscheidet und diese Bögen von der Falzvorrichtung unterschiedlich gefalzt werden, so daß sich bei den aus der Falzvorrichtung austretenden Bögen je nach Seitenmaß des Bogens vor seinem Falzen ein unterschiedliche Anzahl von übereinanderliegenden Lagen ergibt, gekennzeichnet durch eine Vorrichtung zur Signalgebung, wenn ein Behälter (26) der Zusammentrageinrichtung (14) bis zu einem vorbestimmten Grad mit den Bögen gefüllt worden ist, wobei die Vorrichtung folgendes umfaßt:
ein erstes Mittel (102) zur Erzeugung erster Signale, die das Seitenmaß jedes Bogens vor seinem Falzen angeben;
ein auf die ersten Signale reagierendes zweites Mittel zur Erzeugung zweiter Signale mit Werten, die die Anzahl der von der Falzvorrichtung bei jedem Bogen zu bildenden übereinanderliegenden Lagen darstellen, wobei sich dieser gewichtete Wert für jeden Bogen mit der Anzahl der bei jedem Bogen zu bildenden Lagen erhöht; und

ein auf die zweiten Signale reagierendes drittes Mittel zur Erzeugung dritter Signale, die angeben, wenn die Summe der Werte für einem beliebigen der Behälter (26) zugeführte Blätter einen vorbestimmten Bezugswert erreicht, der dem vorbestimmten Füllungsgrad dieses einen Behälters entspricht.

8. Vorrichtung nach Anspruch 7, gekennzeichnet durch ein auf die dritten Signale reagierendes viertes Mittel zur Bestimmung, ob es einen weiteren Behälter (26) der Zusammentrageinrichtung (14) gibt, der nicht auf den vorbestimmten Grad gefüllt ist, und zur Umschaltung der Zuführung der Bögen von diesem einen Behälter weg zu einem anderen Behälter.

9. Vorrichtung nach Anspruch 7, gekennzeichnet durch ein Zusammentrageinrichtungssteuermittel (112) zur Bereitstellung eines ersten Satze aus N Behältern zum Empfang der Verteilung der Bögen von der Falzvorrichtung (12), ein auf die dritten Signale reagierendes Mittel zur Erfassung des Vorhandenseins eines anderen Satzes aus N verschiedenen Behältern in der Zusammentrageinrichtung, die nicht auf den vorbestimmten Grad gefüllt sind, und ein auf die dritten Signale reagierendes Mittel zur Umschaltung der Verteilung der Bögen von dem ersten Satz aus N Behältern (26) auf einen anderen Satz aus N Behältern (26).

10. Verfahren der seriellen Verteilung aufeinanderfolgender Gruppen von Materialbögen auf eine erste Mehrzahl von Lagerungsbehältern (26) gemäß einem vorbestimmten gewünschten Verteilungsmuster für jede Gruppe, wenn die Vorrichtung aus Anspruch 1 verwendet wird, gekennzeichnet durch

Überwachung der jedem der Behälter (26) zugeführten Bogenmenge zur Erzeugung sie darstellender erster Signale;

- als Reaktion auf diese ersten Signale - Speicherung einer entsprechenden Mehrzahl von die Menge der Bögen, die entsprechenden jeweiligen Bogenlagerungsbehältern (26) zugeführt wurden, darstellenden Signalen in einer Mehrzahl von Signalspeicherregistern:

  Erzeugung zweiter Signale, die den gewünschten Verteilungsmustern entsprechen;

  Verwendung dieser zweiten Signale zur Steuerung der Bogenverteilung auf die Behälter gemäß dem Verteilungsmuster;

- vor der Verteilung der Bögen aus jeder der Gruppen auf die Behälter - Überprüfung der dann in den Speicherregistern vorhandenen Werte zur Identifizierung eines Satzes Behälter, der dazu geeignet ist, die jeweilige Gruppe von Bögen aufzunehmen, und zur Erzeugung dritter Signale, die die Position dieses Satzes Behälter angeben; und

  Steuerung der Verteilung als Reaktion auf die dritten Signale zur Bewirkung der Zufuhr jeder der Gruppen von Bögen zu einem entsprechenden geeigneten Satz Behälter.

11. Verfahren nach Anspruch 10, dadurch gekennzeichnet, daß verschiedene Bögen aus einigen Gruppen unterschiedliche Anzahlen von übereinanderliegenden Lagen aufweisen und das Verfahren die Erzeugung vierter Signale, die die Gesamtanzahl von Lagen bei den jedem Behälter zugeführten Bögen angeben, und fünfter Signale umfaßt, die angeben, wenn die Gesamtanzahl von Lagen einen vorbestimmten Bezugswert für einen beliebigen der Behälter übersteigt.

12. Verfahren nach Anspruch 11, gekennzeichnet durch Bestimmung, ob eine andere Mehrzahl von Behältern (26) zur Aufnahme zusätzlicher Bögen zur Verfügung steht, wenn das fünfte Signal erzeugt wird, und - falls dies der Fall ist - Umschaltung danach der Verteilung von Bögen von der ersten Mehrzahl von Behältern auf diese andere Mehrzahl von Behältern.

13. Verfahren nach Anspruch 12 gekennzeichnet durch Erzeugung eines sechsten Signals, wenn die Bestimmung zeigt, daß keine andere Mehrzahl von Behältern zur Verfügung steht.

14. Verfahren nach Anspruch 5, dadurch gekennzeichnet, daß das Behälterumschaltmittel ein Bogenerfassungsmittel (PS 14) zur Erfassung des Eintritts jedes Bogens in die Zusammentrageinrichtung (14), um ein Bogeneintritts-Anzeigesignal zu erzeugen, und ein auf das Bogeneintritts-Erfassungssignal reagierendes Mittel (80) zur Erzeugung eines weiteren Signals, das angibt, ob der unmittelbar folgende Bogen einen Behälter der Zusammentrageinrichtung (14) überfüllen wird, umfaßt.

15. Vorrichtung nach Anspruch 14, dadurch gekennzeichnet, daß das Behälterumschaltmittel ein auf das weitere Signal reagierendes Mittel zur Bestimmung, ob das Behälterumschaltmittel betätigt werden soll, um ein Überfüllen der Zusammentrageinrichtung zu verhindern, umfaßt.

Revendications

1. Appareil (40) de distribution de feuilles comprenant une pluralité de casiers (26) pour recevoir et stocker des feuilles de matériau, quelques-unes ou l'ensemble d'entre elles pouvant être pliées une ou plusieurs fois, et un moyen (20,24) pour introduire lesdites feuilles dans lesdits casiers, caractérisé par

un moyen (PS2-PS6) de détection de feuilles pour détecter le nombre de panneaux superposés dans chacune desdites feuilles avant de les introduire dans un premier ensemble dedits casiers (26) et pour produire des signaux représentatifs de l'épaisseur totale effective des feuilles introduites dans chacun desdits casiers; et

un moyen (112,52) d'aiguillage de casiers sensible auxdits signaux pour aiguiller ladite introduction desdites feuilles depuis ledit premier ensemble de casiers (26) vers un deuxième ensemble dedits casiers (26) lorsqu'un desdits casiers dudit premier ensemble s'est substantiellement rempli dedites feuilles.

2. L'appareil de la revendication 1, caractérisé par le fait que ledit deuxième ensemble de casiers (26) est complètement indépendant dudit premier ensemble de casiers.

3. L'appareil de la revendication 2, caractérisé par le fait que ledit premier ensemble de casiers (26) comprend moins de la moitié du nombre total de casiers dudit appareil (40) et ledit autre ensemble de casiers est indépendant dudit premier ensemble de casiers et y est égal en nombre.

4. L'appareil de la revendication 3, caractérisé par le fait que lesdites feuilles de matériau introduites dans lesdits casiers (26) comprennent une succession de feuilles intégrales séparées dont les spécimens différents ont des nombres différents de panneaux imbriqués.

5. L'appareil de la revendication 1, caractérisé par le fait que lesdites feuilles introduites dans lesdits casiers (26) comprennent une succession de feuilles intégrales séparées dont les spécimens différents ont des nombres différents de panneaux imbriqués; ledit moyen de détection du nombre desdits panneaux pour chaque feuille comprend un moyen (102) pour produire des premiers signaux indiquant le nombre de panneaux imbriqués dans chacune desdites feuilles; et ledit moyen (112,52) d'aiguillage de casiers comprend un moyen pour attribuer des valeurs différentes auxdites feuilles selon le nombre de leurs dits panneaux imbriqués, avec des valeurs plus grandes attribuées aux feuilles ayant de plus grands nombres de panneaux et un moyen pour produire un signal (100) d'aiguillage de casiers quand la somme desdites valeurs pour les feuilles transférées dans l'un quelconque dudit premier ensemble de casiers (26) atteint un niveau prédéterminé.

6. L'appareil de la revendication 1, caractérisé par le fait que le nombre total desdits casiers (26) est au moins le double du nombre de casiers dans ledit premier ensemble, et ledit moyen (112,52) d'aiguillage de casiers est sensible audit moyen (102) de détection de feuilles pour aiguiller ladite introduction desdites feuilles depuis ledit premier ensemble de casiers (26) jusqu'à un deuxième ensemble indépendant dudit premier ensemble et égal en nombre audit premier ensemble.

7. L'appareil de la revendication 1 ayant, en association, un plioir de feuilles (12) et un collateur de feuilles (14) pour recevoir automatiquement une série de feuilles de matériau à partir du plioir (12) dans les casiers (26) du collateur (14), lesdites feuilles entrant dans ledit plioir différant en taille latérale et étant pliées différemment par ledit plioir pour produire des nombres différents de panneaux superposés dans les feuilles sortant dudit plioir suivant la taille latérale de la feuille avant d'être pliée:

caractérisé par un appareil pour signaler quand un casier (26) dans ledit collateur (14) a été rempli dedites feuilles à un degré prédéterminé, ledit appareil comprenant

un premier moyen (102) pour produire des premiers signaux indicatifs de la taille latérale de chaque feuille avant d'être pliée;

un deuxième moyen sensible auxdits premiers signaux pour produire des deuxièmes signaux ayant des valeurs représentatives du nombre de panneaux superposés à être formés dans chaque feuille par ledit plioir, ladite valeur pondérée pour chaque feuille augmentant avec le nombre dedits panneaux à être formés dans chaque dite feuille; et

un troisième moyen sensible auxdits deuxièmes signaux pour produire des troisièmes signaux indicatifs du moment où la somme desdites valeurs pour des feuilles délivrées à l'un quelconque desdits casiers (26) atteint une valeur de référence prédéterminée correspondant audit degré prédéter-

miné d'état de remplissage dudit casier.

8. L'appareil de la revendication 7, caractérisé par un quatrième moyen sensible auxdits troisièmes signaux pour déterminer s'il existe un autre casier (26) dudit collateur (14) qui n'est pas rempli audit degré prédéterminé, et pour aiguiller la distribution desdites feuilles depuis ledit casier vers un autre casier.

9. L'appareil de la revendication 7, caractérisé par un moyen de commande (112) du collateur pour préparer un premier ensemble de N casiers à recevoir la distribution desdites feuilles à partir dudit plioir (12), des moyens sensibles auxdits troisièmes signaux pour détecter l'existence d'un autre ensemble de N casiers différents dans ledit collateur qui ne sont pas remplis audit degré prédéterminé, et des moyens sensibles auxdits troisièmes signaux pour aiguiller la livraison desdites feuilles depuis ledit premier ensemble de N casiers (26) vers ledit autre ensemble de N casiers (26).

10. Méthode de distribution de groupes successifs de feuilles de matériau par série à une première pluralité de casiers de stockage (26) selon un type de distribution désiré prédéterminé pour chaque groupe lors de l'utilisation de l'appareil de la revendication 1, caractérisée par

le contrôle de la quantité de feuilles délivrées à chacun desdits casiers (26) pour créer des premiers signaux représentatifs de ceci;

en réponse auxdits premiers signaux, le stockage, dans une pluralité de registres de stockage de signaux, d'une pluralité correspondante de valeurs représentatives de la quantité desdites feuilles délivrées aux casiers (26) de stockage de feuilles respectifs correspondants;

la création de deuxièmes signaux représentatifs desdits types de distribution désirés;

l'application desdits deuxièmes signaux à la commande de ladite distribution de feuilles auxdits casiers selon lesdits types de distribution;

antérieurement à la distribution desdites feuilles de chacun desdits groupes auxdits casiers, la vérification desdites valeurs se trouvant alors dans lesdits registres de stockage pour identifier un ensemble de casiers approprié pour recevoir chacun desdits groupes de feuilles et pour produire des troisièmes signaux indicatifs de l'emplacement dudit ensemble de casiers; et

la commande de ladite distribution en réponse auxdits troisièmes signaux pour effectuer la livraison de chacun desdits groupes de feuilles à un ensemble de casiers approprié correspondant.

11. La méthode de la revendication 10, caractérisée par le fait que des feuilles différentes de certains groupes ont des nombres différents de panneaux superposés, et ladite méthode comprend la production de quatrièmes signaux indicatifs du nombre total de panneaux dans les feuilles délivrées à chaque casier et la production de cinquièmes signaux indicatifs du moment où ledit nombre total de panneaux dépasse une valeur de référence prédéterminée pour l'un quelconque desdits casiers.

12. La méthode de la revendication 11, caractérisée par la faculté de déterminer si une autre pluralité de casiers (26) est disponible pour recevoir des feuilles supplémentaires quand ledit cinquième signal est produit, et si c'est le cas, d'aiguiller par la suite la distribution des feuilles depuis ladite première pluralité de casiers vers ladite autre pluralité de casiers.

13. La méthode de la revendication 12, caractérisée par la production d'un sixième signal dans l'éventualité où ladite détermination indique qu'une autre pluralité de casiers n'est pas disponible.

14. L'appareil de la revendication 5, caractérisé par le fait que ledit moyen d'aiguillage de casiers comprend un moyen (PS14) de détection de feuilles pour détecter l'entrée de chaque feuille à l'intérieur dudit collateur (14) pour produire un signal indicateur d'entrée de feuille, et un moyen (80) sensible audit signal indicateur d'entrée de feuille pour produire un signal supplémentaire indiquant si la feuille suivant immédiatement derrière fera déborder un casier dudit collateur (14).

15. L'appareil de la revendication 14, caractérisé par le fait que ledit moyen d'aiguillage de casiers comprend un moyen sensible audit signal supplémentaire pour déterminer si ledit moyen d'aiguillage de casiers doit être actionné pour empêcher le débordement dudit collateur.

FIG. 1

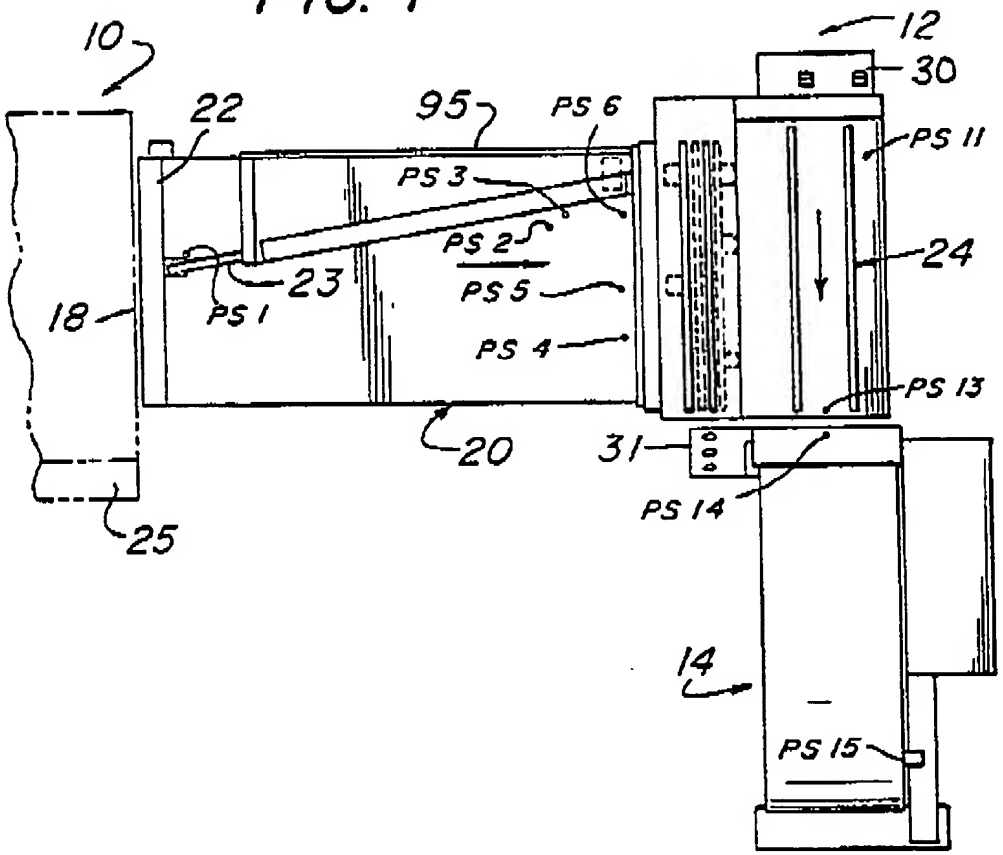

10
12
30
22
95
PS 6
PS 11
PS 3
PS 2
24
23
PS 1
18
PS 5
PS 4
PS 13
20
31
PS 14
25
14
PS 15

FIG. 2

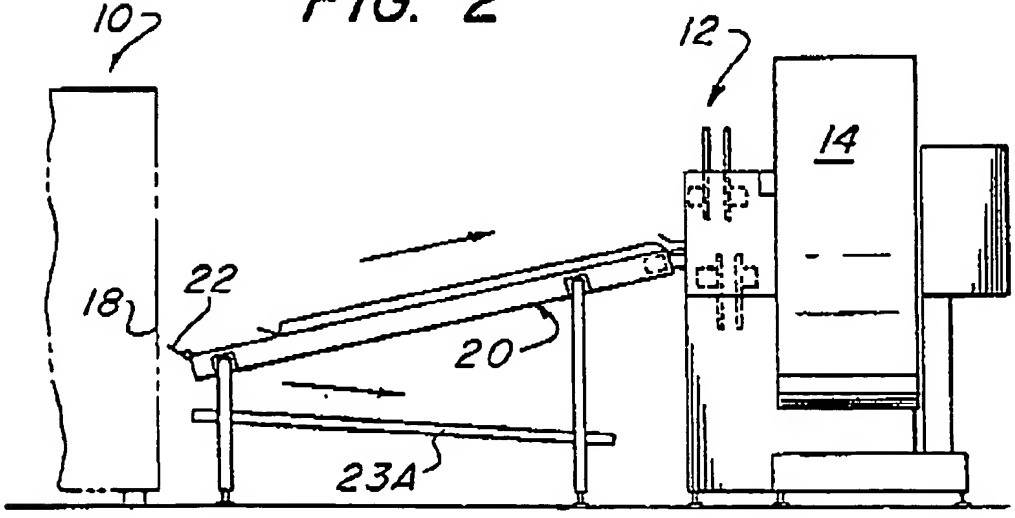
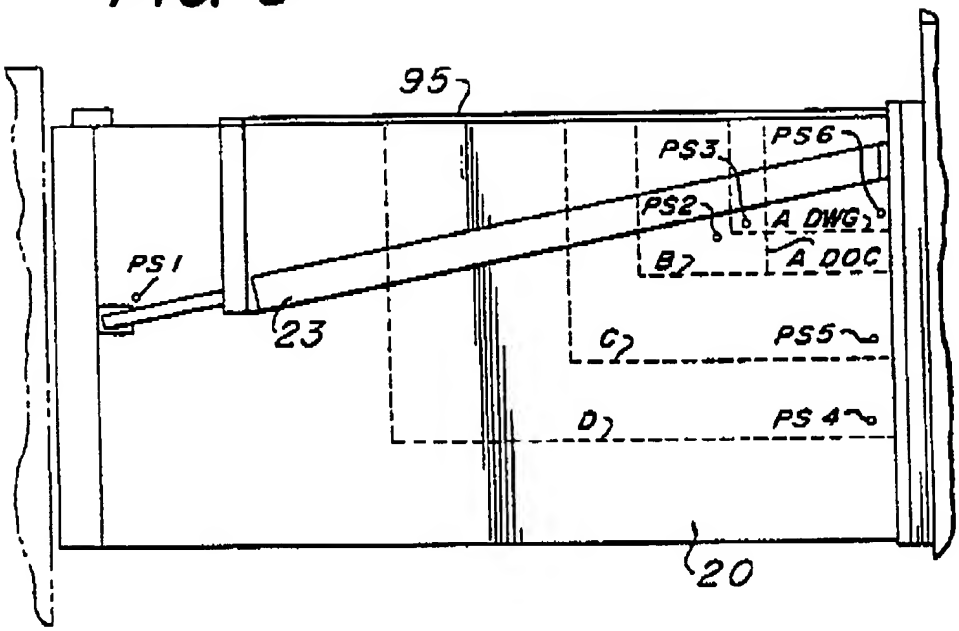

10
12
14
18
22
20
23A

FIG. 3


95
PS3
PS6
PS2
A DWG
B
A DOC
PS 1
23
C
PS5
D
PS 4
20

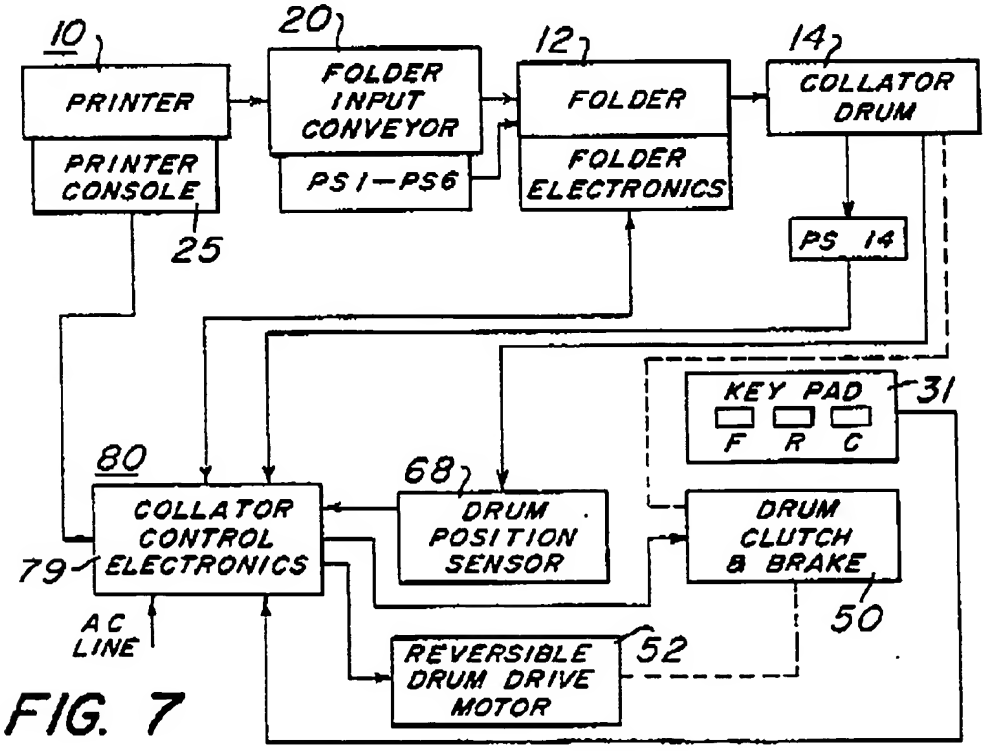

10
PRINTER
PRINTER CONSOLE
25
20
FOLDER INPUT CONVEYOR
PS 1—PS6
12
FOLDER
FOLDER ELECTRONICS
14
COLLATOR DRUM
PS 14
KEY PAD
F R C
31
80
COLLATOR CONTROL ELECTRONICS
79
AC LINE
68
DRUM POSITION SENSOR
DRUM CLUTCH & BRAKE
50
REVERSIBLE DRUM DRIVE MOTOR
52

FIG. 7

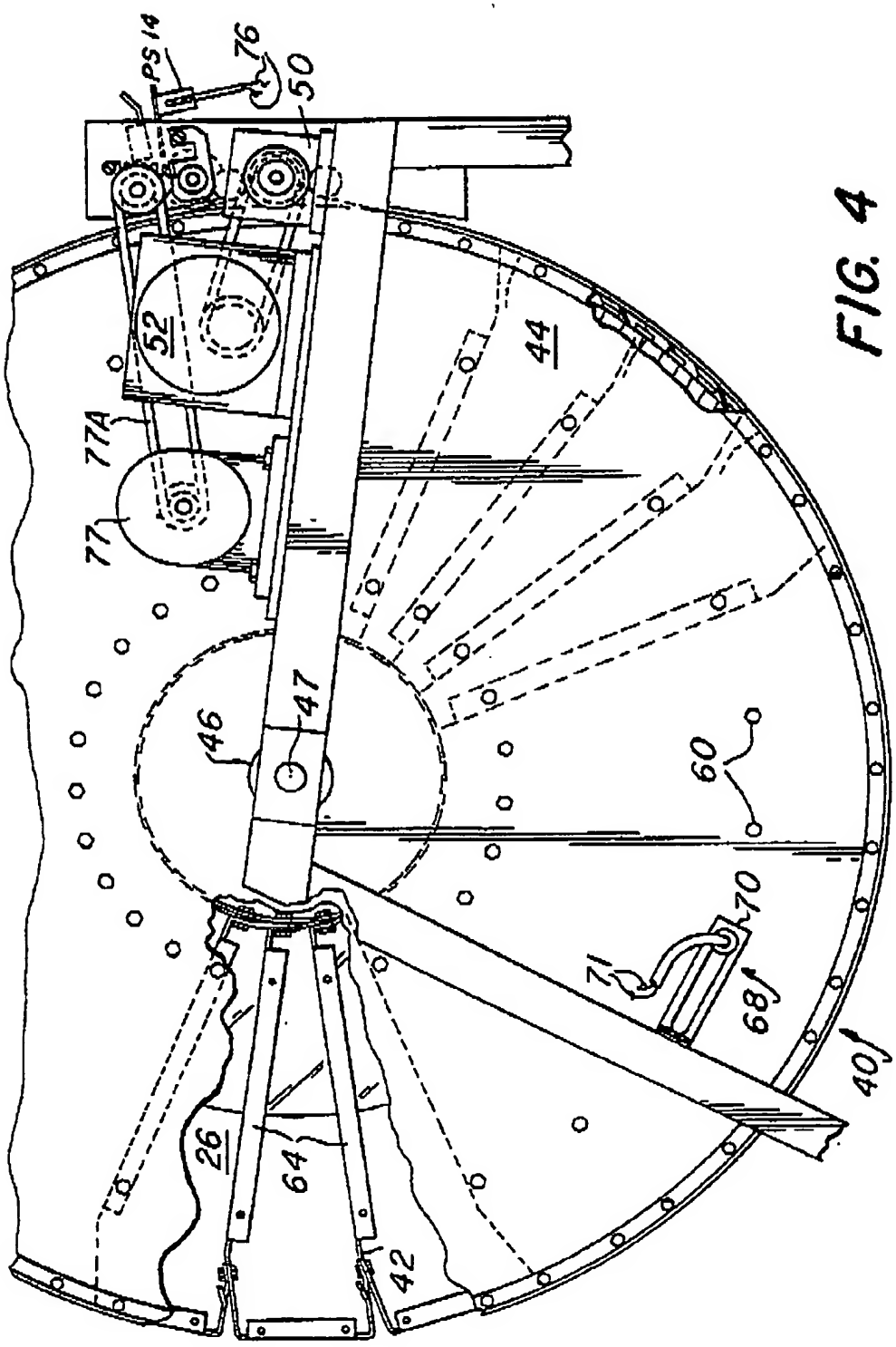


FIG. 4

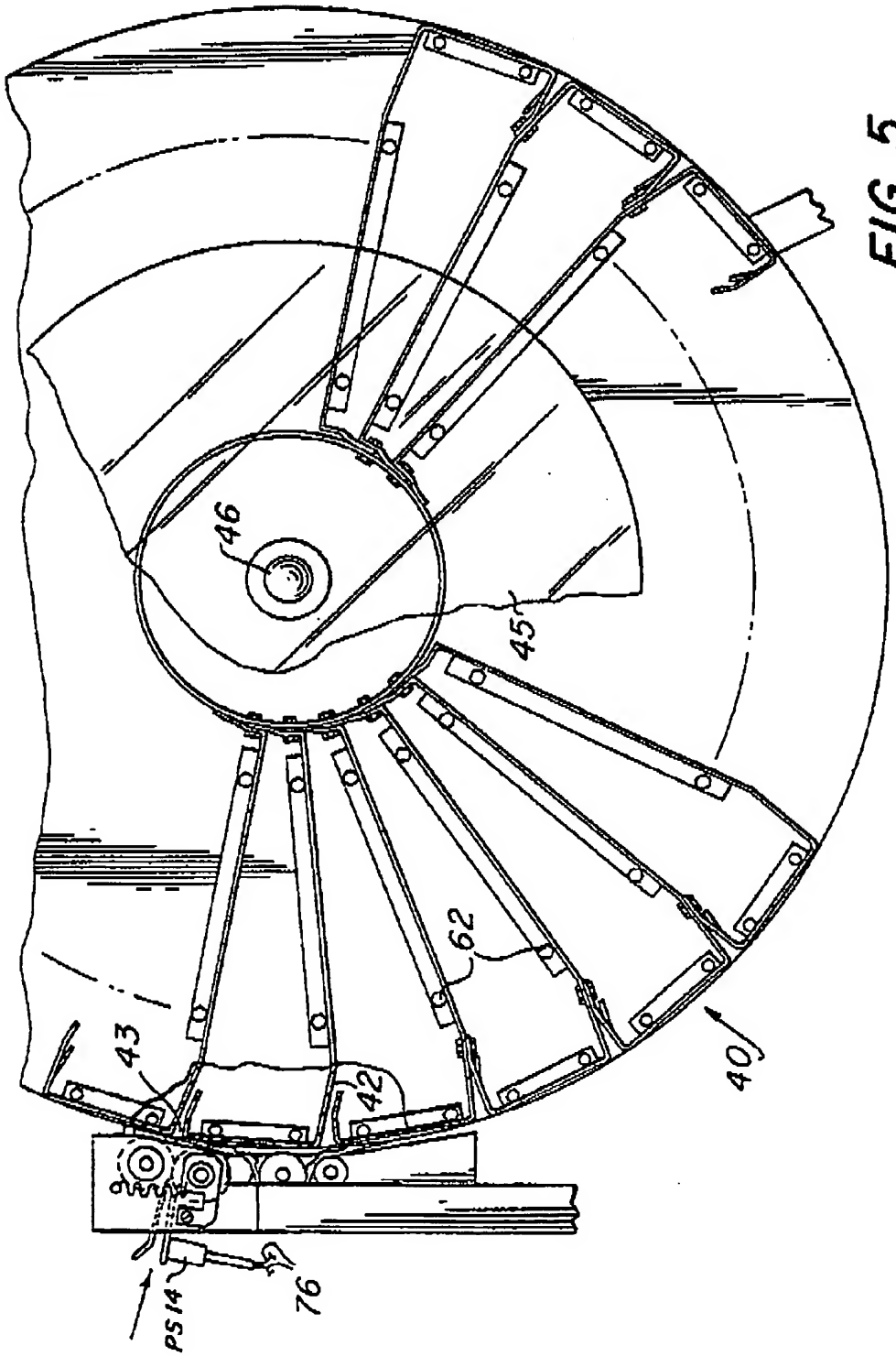


FIG. 5

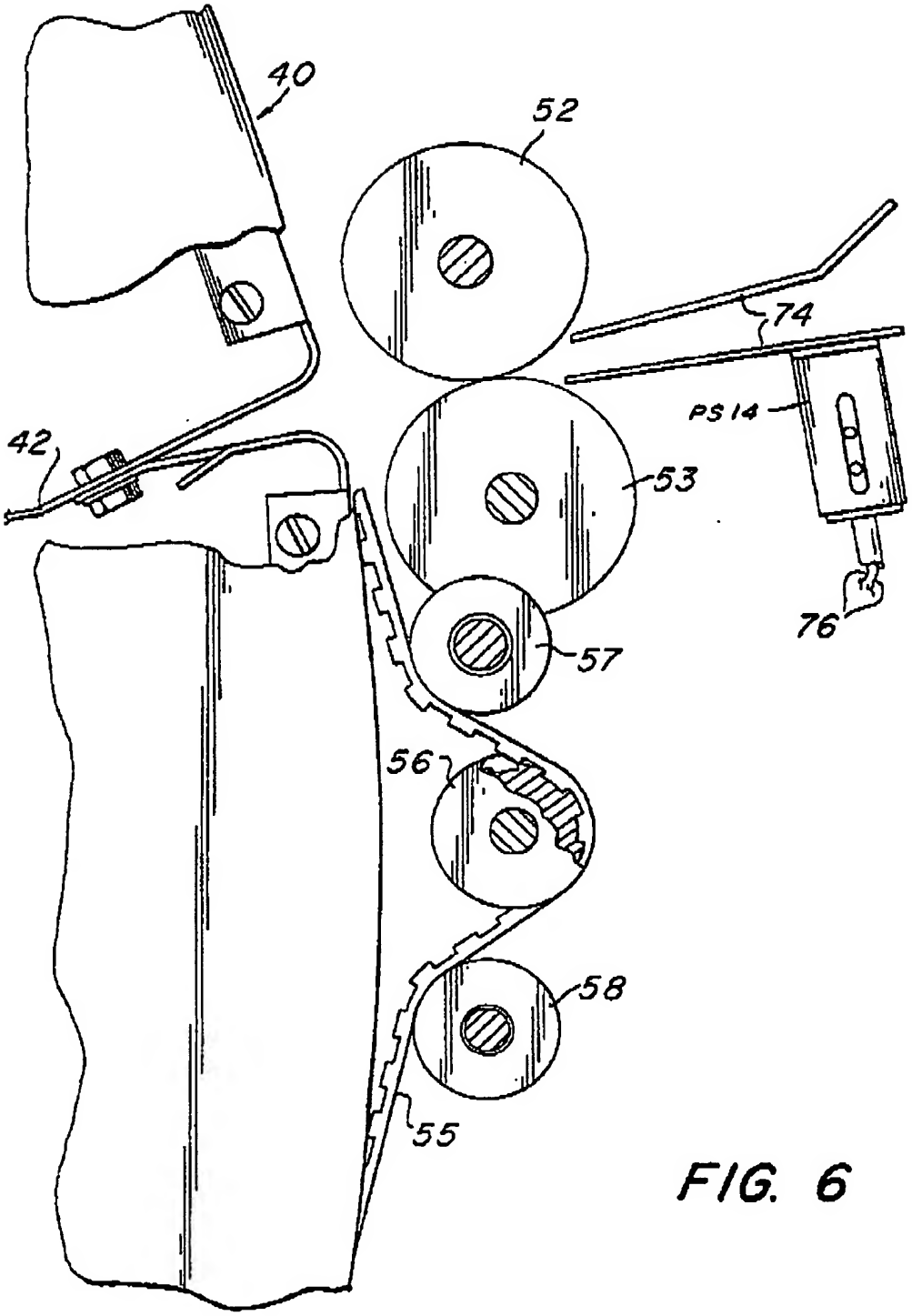


FIG. 6

FIG. 8

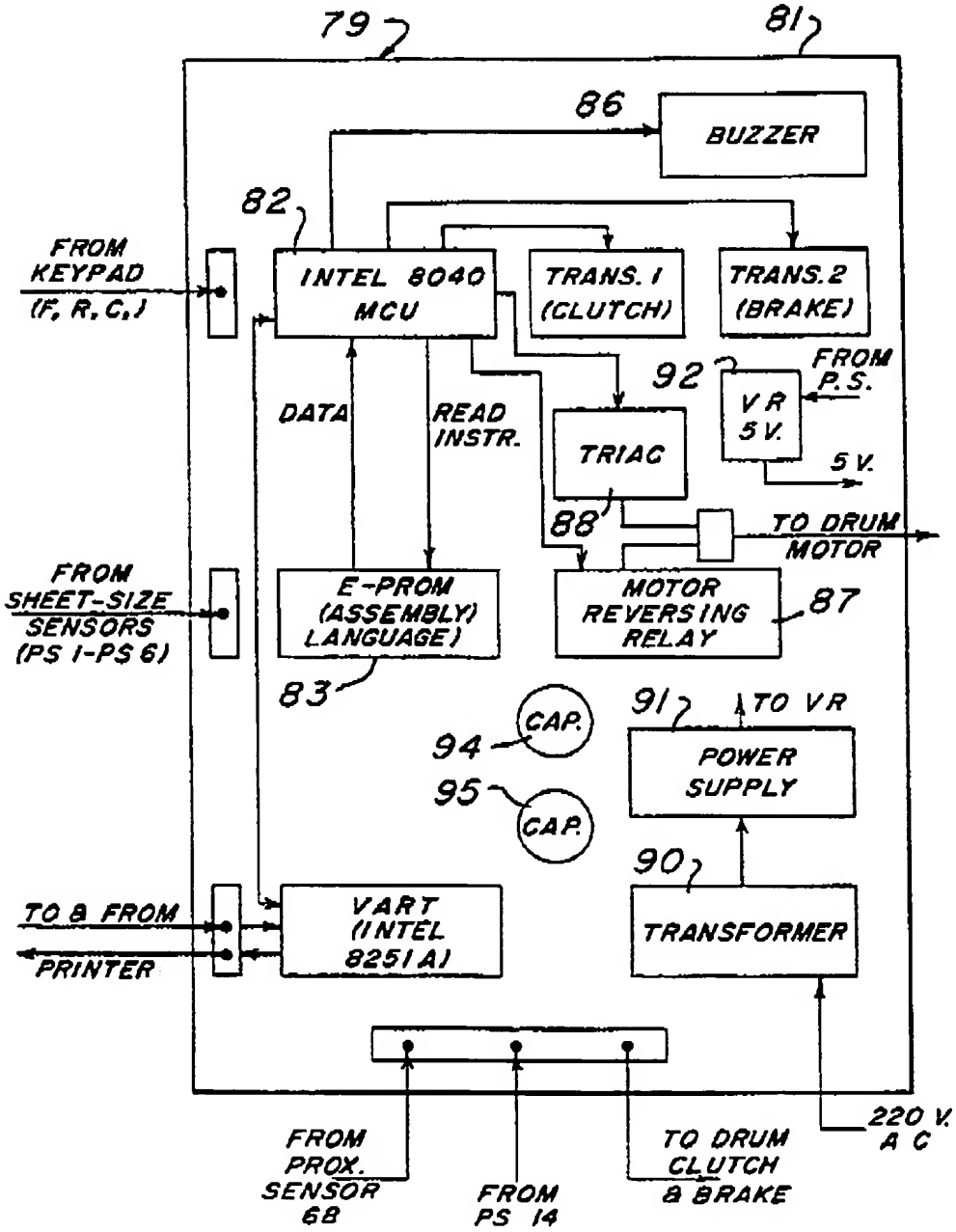
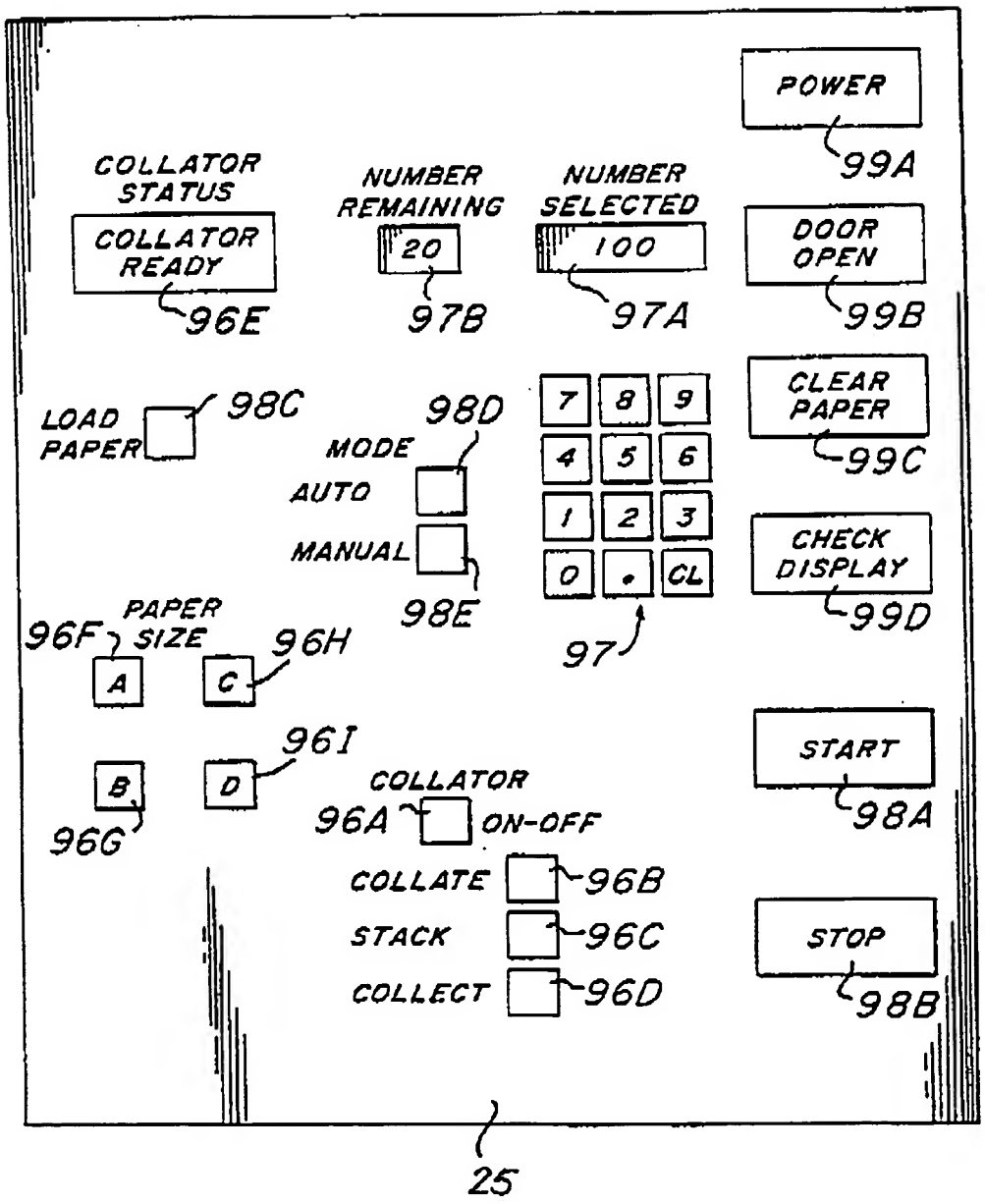

79
81
86
BUZZER
82
FROM KEYPAD (F, R, C,)
INTEL 8040 MCU
TRANS. 1 (CLUTCH)
TRANS. 2 (BRAKE)
92
FROM P.S.
VR 5V.
5 V.
DATA
READ INSTR.
TRIAC
88
TO DRUM MOTOR
FROM SHEET-SIZE SENSORS (PS 1-PS 6)
E-PROM (ASSEMBLY) LANGUAGE)
MOTOR REVERSING RELAY
87
83
91
TO VR
CAP.
94
POWER SUPPLY
95
CAP.
90
TO & FROM PRINTER
VART (INTEL 8251A)
TRANSFORMER
220 V. A C
FROM PROX. SENSOR 68
FROM PS 14
TO DRUM CLUTCH & BRAKE

FIG. 9


POWER
99A
COLLATOR STATUS
COLLATOR READY
96E
NUMBER REMAINING
20
97B
NUMBER SELECTED
100
97A
DOOR OPEN
99B
LOAD PAPER
98C
98D
MODE
AUTO
MANUAL
98E
7 8 9
4 5 6
1 2 3
0 . CL
97
CLEAR PAPER
99C
CHECK DISPLAY
99D
PAPER SIZE
96F
A
96H
C
B
96G
D
96I
COLLATOR
96A
ON-OFF
COLLATE
96B
STACK
96C
COLLECT
96D
START
98A
STOP
98B
25

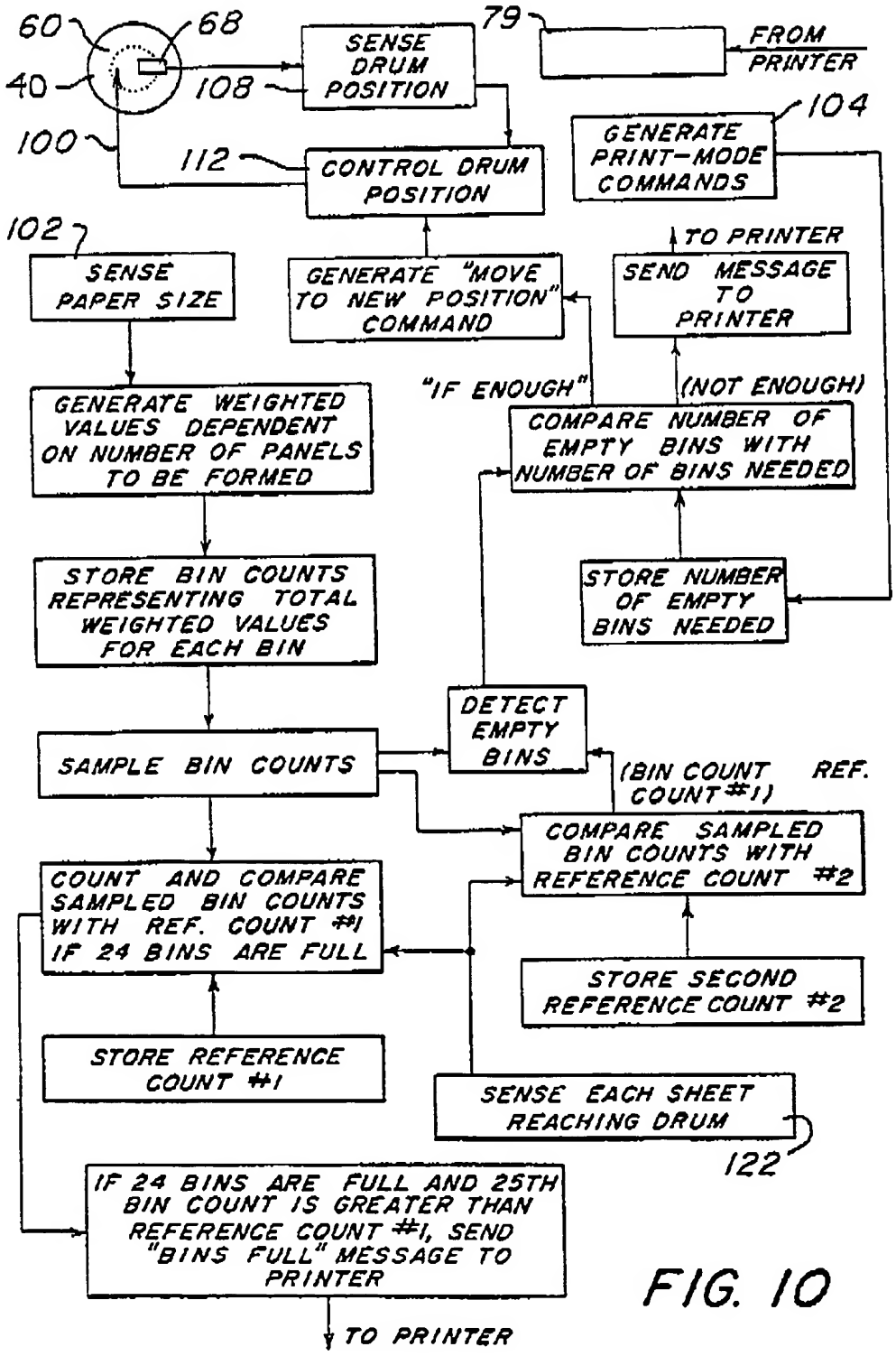

60
68
40
108
100
112
SENSE DRUM POSITION
CONTROL DRUM POSITION
79
FROM PRINTER
104
GENERATE PRINT-MODE COMMANDS
102
SENSE PAPER SIZE
GENERATE "MOVE TO NEW POSITION" COMMAND
TO PRINTER
SEND MESSAGE TO PRINTER
"IF ENOUGH"
(NOT ENOUGH)
GENERATE WEIGHTED VALUES DEPENDENT ON NUMBER OF PANELS TO BE FORMED
COMPARE NUMBER OF EMPTY BINS WITH NUMBER OF BINS NEEDED
STORE BIN COUNTS REPRESENTING TOTAL WEIGHTED VALUES FOR EACH BIN
STORE NUMBER OF EMPTY BINS NEEDED
DETECT EMPTY BINS
SAMPLE BIN COUNTS
(BIN COUNT REF. COUNT #1)
COMPARE SAMPLED BIN COUNTS WITH REFERENCE COUNT #2
COUNT AND COMPARE SAMPLED BIN COUNTS WITH REF. COUNT #1 IF 24 BINS ARE FULL
STORE SECOND REFERENCE COUNT #2
STORE REFERENCE COUNT #1
SENSE EACH SHEET REACHING DRUM
122
IF 24 BINS ARE FULL AND 25TH BIN COUNT IS GREATER THAN REFERENCE COUNT #1, SEND "BINS FULL" MESSAGE TO PRINTER
TO PRINTER

FIG. 10

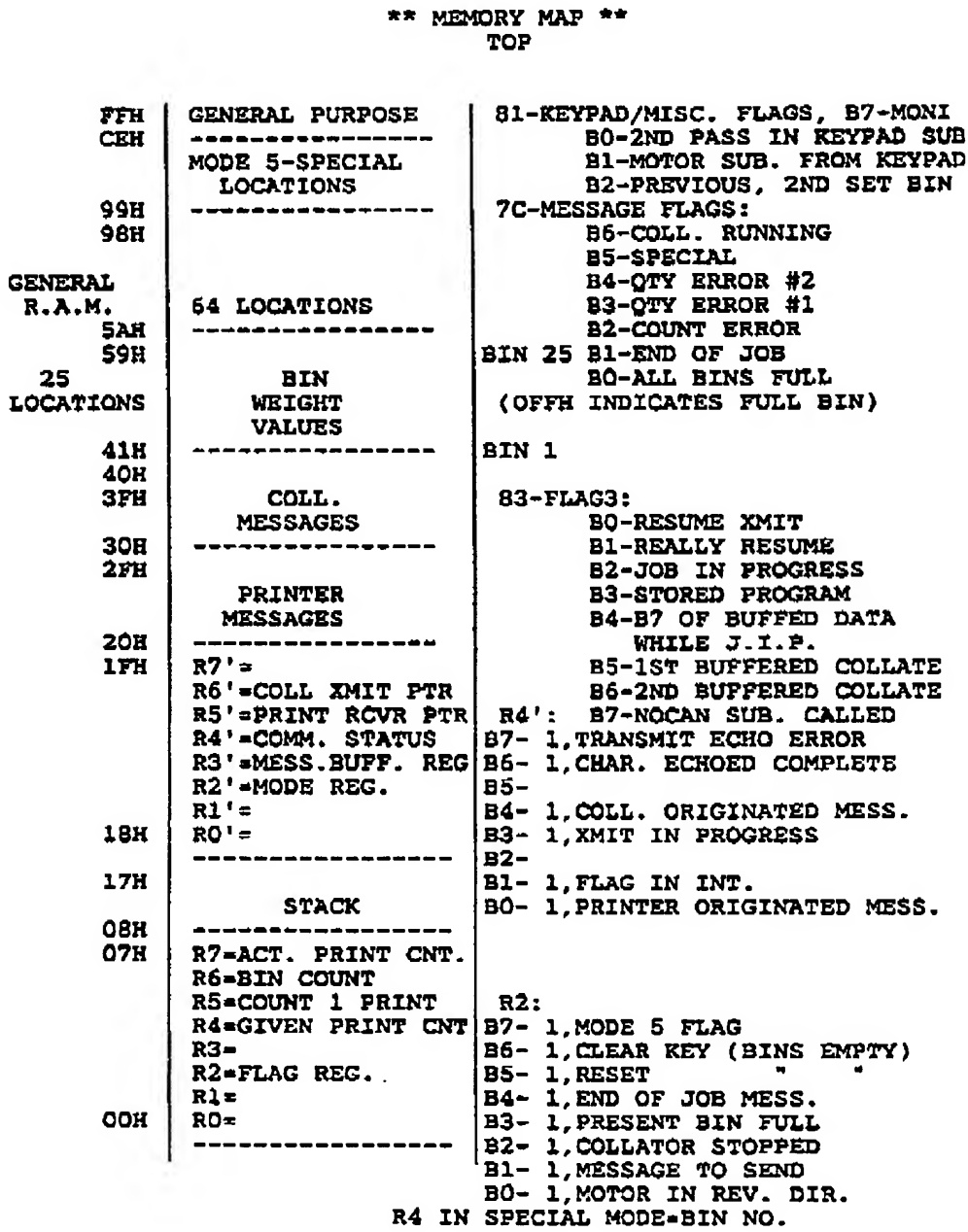
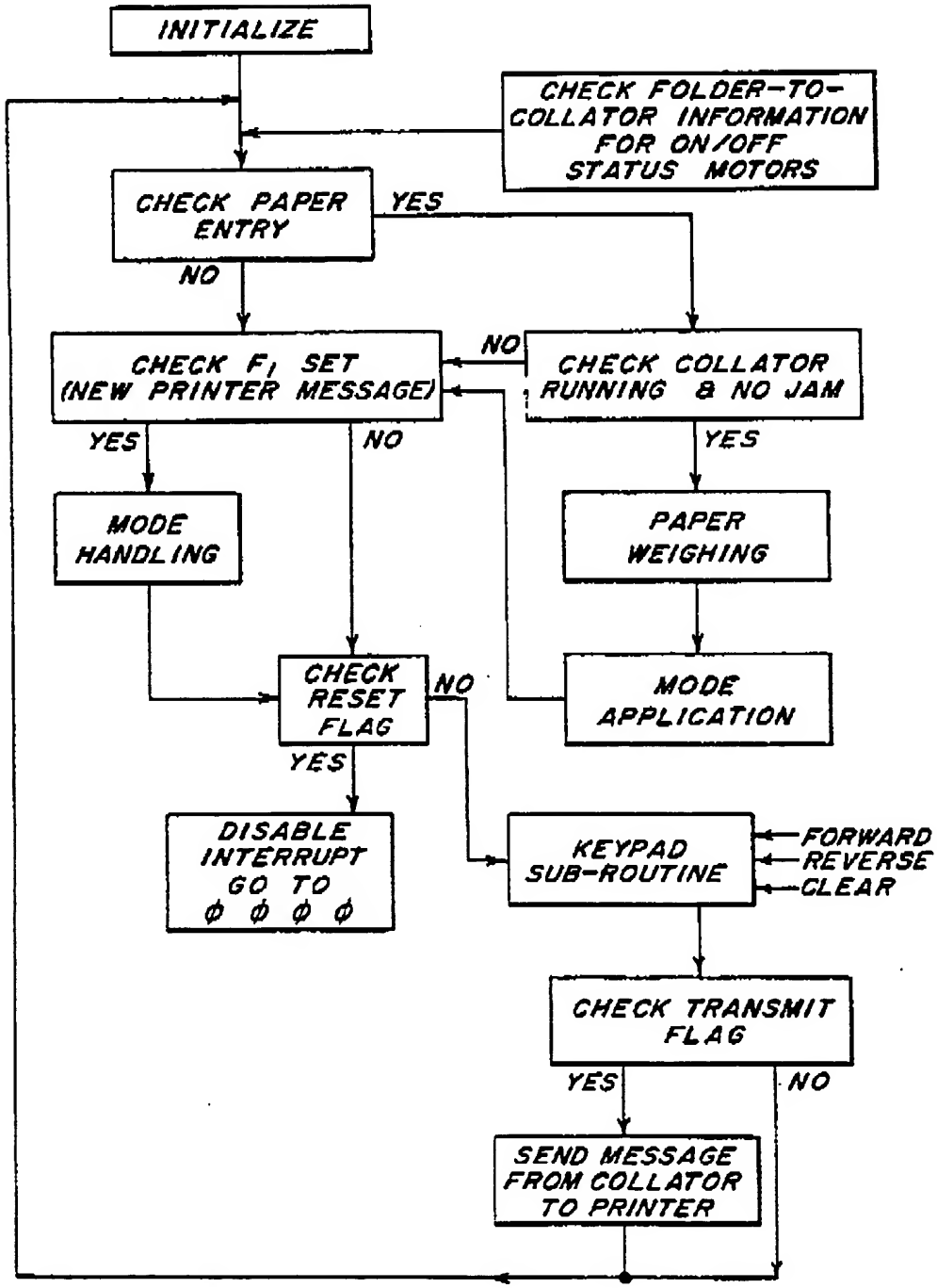

** MEMORY MAP **
TOP
FFH
CEH
99H
98H
GENERAL R.A.M.
64 LOCATIONS
5AH
59H
25 LOCATIONS
BIN WEIGHT VALUES
41H
40H
3FH
COLL. MESSAGES
30H
2FH
PRINTER MESSAGES
20H
1FH
18H
17H
STACK
08H
07H
00H
GENERAL PURPOSE
MODE 5-SPECIAL LOCATIONS
R7'=
R6'=COLL XMIT PTR
R5'=PRINT RCVR PTR
R4'=COMM. STATUS
R3'=MESS.BUFF. REG
R2'=MODE REG.
R1'=
R0'=
R7=ACT. PRINT CNT.
R6=BIN COUNT
R5=COUNT 1 PRINT
R4=GIVEN PRINT CNT
R3=
R2=FLAG REG.
R1=
R0=
81-KEYPAD/MISC. FLAGS, B7-MONI
B0-2ND PASS IN KEYPAD SUB.
B1-MOTOR SUB. FROM KEYPAD
B2-PREVIOUS, 2ND SET BIN
7C-MESSAGE FLAGS:
B6-COLL. RUNNING
B5-SPECIAL
B4-QTY ERROR #2
B3-QTY ERROR #1
B2-COUNT ERROR
BIN 25 B1-END OF JOB
B0-ALL BINS FULL
(OFFH INDICATES FULL BIN)
BIN 1
83-FLAG3:
B0-RESUME XMIT
B1-REALLY RESUME
B2-JOB IN PROGRESS
B3-STORED PROGRAM
B4-B7 OF BUFFED DATA WHILE J.I.P.
B5-1ST BUFFERED COLLATE
B6-2ND BUFFERED COLLATE
R4': B7-NOCAN SUB. CALLED
B7- 1,TRANSMIT ECHO ERROR
B6- 1,CHAR. ECHOED COMPLETE
B5-
B4- 1,COLL. ORIGINATED MESS.
B3- 1,XMIT IN PROGRESS
B2-
B1- 1,FLAG IN INT.
B0- 1,PRINTER ORIGINATED MESS.
R2:
B7- 1,MODE 5 FLAG
B6- 1,CLEAR KEY (BINS EMPTY)
B5- 1,RESET " "
B4- 1,END OF JOB MESS.
B3- 1,PRESENT BIN FULL
B2- 1,COLLATOR STOPPED
B1- 1,MESSAGE TO SEND
B0- 1,MOTOR IN REV. DIR.
R4 IN SPECIAL MODE=BIN NO.

FIG. 11

FIG. 12


INITIALIZE
CHECK FOLDER-TO-COLLATOR INFORMATION FOR ON/OFF STATUS MOTORS
CHECK PAPER ENTRY
YES
NO
CHECK F1 SET (NEW PRINTER MESSAGE)
NO
CHECK COLLATOR RUNNING & NO JAM
YES
NO
YES
MODE HANDLING
PAPER WEIGHING
CHECK RESET FLAG
NO
MODE APPLICATION
YES
DISABLE INTERRUPT GO TO ϕ ϕ ϕ ϕ
KEYPAD SUB-ROUTINE
FORWARD
REVERSE
CLEAR
CHECK TRANSMIT FLAG
YES
NO
SEND MESSAGE FROM COLLATOR TO PRINTER